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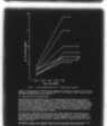
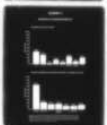
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## The Impact of Future Developments in Communications, Information Technology and National Policies on the Work of the Aerospace Information Specialist

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- Exchanging of scientific and technical information;
- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture;
- Improving the co-operation among member nations in aerospace research and development;
- Providing scientific and technical advice and assistance to the North Atlantic Military Committee in the field of aerospace research and development;
- Rendering scientific and technical assistance, as requested, to other NATO bodies and to member nations in connection with research and development problems in the aerospace field;
- Providing assistance to member nations for the purpose of increasing their scientific and technical potential;
- Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community.

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### THEME

↙ The rapid development of new communication techniques, combined with greatly reduced unit costs of communication hardware, has led to easier access to more information for larger segments of the population. In the area of aerospace scientific and technical information, this development should provide greater opportunities for making systematic use of mankind's aggregated experience and knowledge, collected and stored over time. However, good use can only be made of these opportunities if preparations are begun now.

The role of the information specialist is undoubtedly changing with the advent of these developments, and it may also be desirable for him to influence their future course. The theme of this Meeting was to identify the main trends in communications and information technology, to assess their impact on the information specialist, and to consider what other developments might be desirable, particularly in relation to aerospace scientific and technical information. To this end, it brought together those in the forefront of these technologies and the information specialists who will have to make use of them, or provide complementary services, in order that each may benefit from the other's knowledge and experience. In addition, a number of papers outlined national plans for the future of their Scientific and Technical Information activities. ↑

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\* Not available.

## THE NORWEGIAN-SCANDINAVIAN SCIENTIFIC AND TECHNICAL INFORMATION SCENE

A. Disch, Director  
Norwegian Centre for Informatics  
Oslo, Norway

### FROM QUANTITY TO QUALITY

One of today's worries seems to be that the future no longer is what it used to be. We have tried to do something about this. We have made use of technical forecast studies, long-term planning programs, Delphi analysis techniques, scenario writings and other tricks of the trade. The results have often been quite interesting, not always equally reliable, not always in agreement with each other, except for one fact that everybody seems to agree upon: today's worries will be tomorrow's problems and today's problems may easily develop into tomorrow's sorrows, if we don't do something about it.

Today's established generation had, comparatively speaking, clearly defined, easily understood and generally accepted objectives in life: to get an education, to prepare for a job to support a family, to strive for an acceptable standard of living.

Today's younger generation, however, has either assumed this standard of living as an obvious birthright - or rejected it completely. Instead, its voice sounds loudly - clearly - and frequently - about the need to shift our attention from the materialistic aspects of our present, Western society: from standard of living, to standard of life, from quantity of things to quality of actions. And we, the members of the Establishment have come a long way in accepting this shifting of attention from quantity to quality, from the size of cars to the functions of cars in a society that is increasingly polluted not only by their fumes, but also by their ever-increasing numbers.

The basis for such a change of attitude, or mentality, is the knowledge and understanding of the consequences of one's actions - or lack of action. Information, if well used, may lead to this knowledge, and knowledge - with some luck - may lead to the solution of some of Society's problems - and in a very few cases, even to wisdom.

And wisdom, knowledge, information we definitely need in a world faced by population explosion, pollution, energy crises - and all the other types of crisis.

It used to be believed - and many people still do - that an increased volume and a higher level of information would automatically lead to the solution of today's pressing problems - and indeed even to wisdom. However, an increasing number of people are leaving this congregation whose members believe that the solution to all our problems lies in an ever greater volume of information. Because: - the limiting factor in making good use of information for the benefit of mankind, is not that we don't have enough information. We are, as a matter of fact, drowned daily in information, information we don't want, don't need, don't even ask for. The actual problem is the lack of relevant, timely and terse information and the failure on our part to apply this in defining our objectives and our failure to become emotionally engaged in our society's basic problems.

The fact that this world of ours is facing an unending series of crises, calls therefore for a new understanding of our basic problems, based on information, not necessarily more information or new information, but correct, reliable information, relevant to our needs and available in a useful and applicable form.

### THE INFORMATION USER IN MODERN SOCIETY

In modern society, everybody is an information user; the scientist, the politician, the teacher, the housewife, the student. In the context of this paper, however, we will define the user as the person who can transform available scientific or technical information into new knowledge, new products or new methods for producing present products with less energy and less pollution.

Since we know that scientists and business managers usually have their own, informal information channels and represent a fairly small percentage of the total user community, we will concentrate on the information needs and requirements of the practical engineer, the man or woman whose job it is to solve everyday problems in industry.

In 1971 we carried out a comprehensive survey in Norway. Of a total engineering community of some 30 000 we interviewed 1 400 professional engineers and university graduates in private industry, Government agencies and educational institutions. The interviewees were asked to fill out a questionnaire with 18 detailed questions.

The purpose of the survey was to map and to quantify the use of the different information sources and the user's opinion of these sources related to those cases when these sources had proved to be of actual value to the person interviewed. The survey was limited to information sources in technology and applied science.

One of the conclusions of the survey was that the user, the practical engineer, just is not interested in information, at least not of the type offered in today's information systems. What he is interested in, is the solution to his present and immediate problem. He does not have the time nor the training to make

use of the traditional information sources or channels: abstract journals, primary literature, on-line services, R&D reports, library services.

Instead, he goes to a conveniently located and familiar source with his problem: a supplier, an in-house colleague or file, or he consults the old, familiar textbook where he knows on what page he can find what he needs.

His information requirements are thus dictated more by the need for information to enable him to make an immediate decision than by the need for thoroughly reliable and authoritatively approved information. The decisions he has to make are most often on very down-to-earth problems: the choice of material for a special piece of machinery, the design of a specially shaped, load-bearing wall, the surface treatment of a concrete floor, subjected to acidic liquids.

It is only infrequently that his problem is the kind that can wait for the results of a thorough literature search, whether this be in the manual or in the on-line mode.

This is how he expressed his sentiments about the existing information services:

- "It is the availability of the information that dictates its use. That does not always mean that it is the best information."
- "The suppliers' information is easily available."
- "The technical periodicals seem inaccessible to most users."
- "Don't know much about abstract journals, probably because they are of little use to us."

#### ANOTHER, MORE DETAILED STUDY

In the 1971 survey, a fairly large number of people were included for statistical reasons. This was followed up by another study in 1974/75, where a limited number of people agreed to record in detail over a 30-day period, their daily work tasks and information channels.

##### The Stratification of the 40 Participants in the 1974/75 Study

I	III
Technical Directors	Government Agencies
8 persons	8 persons
age 40 - 60 yrs.	age 25 - 45 yrs.
II	IV
New Technology	Research and Development
5 persons	8 persons
age 25 - 40 yrs.	age 30 - 55 yrs.
	V
	Traditional Technology
	11 persons
	age 30 - 55 yrs.

We wanted to try and find the answers to the following questions:

- Which work situations call for additional general information ?
- How does the user get this additional information ? (His actual use of the different information sources.)
- How does the user rate the quality of these sources with regard to his actual needs (also in relation to cost and time) ?
- How should the need for additional information be met, based on the user's actual work situation and the information sources that are actually available ?

In this study, a fairly broad interpretation of information was used, aimed more at the actual work situation "of direct use in daily work", and "-to make it possible to keep up-to-date and maintain one's professional level", than at an accurate, academic definition. Both in-house sources and own experience were included as information sources.

During the study, the participants made a number of observations and statements:

- The knowledge of available information is very limited.
- Insight into the R&D-institutes' information services is lacking.
- Old sources are maintained even if they are not optimal. New channels are seldom tried, due to lack of knowledge and trust.
- Ease of use is considered more important than reliability.
- Informal, often local sources are preferred when every-day problems have to be solved.
- In-house information meetings with personal contacts are preferred to SDI and library services.

It was reasonable to assume that some of these problems could be solved very easily through discussions with "professional" information specialists by comparing their professional insight into existing and possible alternative sources with the users' own choice of information sources. Discussion sessions were therefore arranged between groups of participants and representatives from library and information services.

The experience of these sessions proved, however, that the "experts" had very limited success in pointing out more optimal uses of information sources. The reason was that the user's need for information was so closely connected to his specific work situation and to his immediate, highly special problem that he, the user, appeared as more of an expert than the "expert" himself on what information sources to consult.

#### THE SCANDINAVIAN SCENE

Let me now turn to our Scandinavian scene: Each of the Scandinavian countries is a small one, with limited resources for research and development. This means that we have to import the greater part of our know-how from abroad. The total amount of R&D carried out in Scandinavia amounts to some 2% of the world's total R&D effort. This means that what we like to call our Scandinavian way of life, is based upon knowledge that, for the greater part, has been imported from countries outside Scandinavia. Which also means that information import becomes very important. However, being small, with limited resources, calls for a cooperative importing effort among the Scandinavian countries. As worded by OECD: "Special consideration should be given to the possibility of pooling resources of smaller countries to avoid the necessity of duplication of national systems. A sharing of experiences among the smaller OECD nations might shed light on problems and alternative strategies in this field."

And this should be particularly applicable to the Scandinavian scene. After all, the Scandinavian countries have always been viewed as a green, peaceful corner of Europe, with friendly, smiling neighbours in amiable conversation across the country borders. No great conflicts, no serious disagreements, at least not so serious that they could not be solved over a glass of aquavit - the graver ones maybe requiring two or three glasses - but they do get solved.

We who live here have a slightly different, a more realistic and faceted view and consider the problems to be more complex, however. The handling of the big issues in recent time has not always been glowing examples of a compassionate, mutual understanding of our neighbours' well-being. Our industrial interests and policies might differ widely, our political considerations be oriented towards the East, South or West. We all have our highly national interests to defend, and there is, after all no particular reason why a Dane from the southern part of Denmark should feel that he has any stronger ties to somebody in northern Norway than to his immediate neighbour in the South.

Except for one thing: There is a Scandinavian "something", a bond which in an almost inexplicable way binds together men from flat Denmark and mountainous Norway, from lake-dotted Finland and industrialized Sweden: A kind of common agreement on a different way of life, one which in some basic aspects differs from the German, French or American ones. This "something" has such a bonding strength, that it holds together, where one would have sworn that, that which pulls apart would have been stronger than that which binds together.

But apart from the more irrational and emotional reasons for Scandinavian cooperation, the cold, inescapable fact remains that individually we are too small to be taken really seriously, but together we represent a factor that has to be reckoned with, even in a global context.

#### SCANDINAVIAN STI-ACTIVITIES

This is true also in the field of information and documentation. To formalize the cooperative efforts in information, two cooperative bodies have been established:

NORDDOK was established in 1971 by the governments of the four Scandinavian countries: Denmark, Finland, Norway and Sweden to promote the organization of Scandinavian documentation cooperation. NORDDOK handled a broad spectrum of questions: STI policy problems, coordinative efforts, research and development in STI, etc. As of January 1977 NORDDOK has been changed into a somewhat larger organization, NORDINFO, to cover regular library activities besides documentation and information, BDI.

NORDFORSK was established in 1947. The central R&D organizations in all five Scandinavian countries (Iceland has joined Nordforsk) are the funding organizations. Nordforsk covers the whole range of technical and applied scientific R&D and has from its beginning considered information and documentation as an important part of its activities. Nordforsk has recently carried out a number of surveys in fields of major importance, including "Technical I&D". To implement the findings of the I&D survey, Nordforsk has appointed a Committee on Technical I&D.

#### THE ESTABLISHMENT OF SCANNET

One of the Nordforsk I&D projects is the establishment of a Scandinavian information network, SCANNET, linking together the major information centers in Scandinavia. By means of mini-computers with a number of terminals, the big (on the Scandinavian scale) national information banks will be linked together in an interactive, de-centralized network of relatively independent segments.

In such a system, queries inappropriate to one system can be shifted over to another. And what we feel is of great importance: special user requirements can be met by special adaptations, and experimentation and innovation can be carried out in parallel.

The SCANNET communication network is engaged in an experimental operation at present. Mr. K. Klintøe will go more into the details in his presentation.

#### THE SOLUTION TO OUR INFORMATION PROBLEM

The traditional approach to the solution of the information problem, is that the information specialists get together, concentrate on the information problems as they are seen from their lofty position, and delight in developing more sophisticated, more automated, more specialist-oriented systems. And in their enthusiasm over the minute details in their interactive, on-line, real-time computerized system for storing, retrieving and disseminating technical information, they often forget for whose benefit this was set up: the user. Who then, is this user? He or she is the person who can transform available scientific or technical information into new knowledge, new products or new methods for producing present products with less energy and less pollution, - and: into a better understanding of his functions and duties in this troubled world of ours.

Do we sometimes forget this person, forget to ask what kind of information he needs or wants, how he wants it, in what form he wants it? Do we forget to ask who he or she is: the scientist? engineer? worker? housewife? politician? The answer is yes. These users all have this in common, that they are in need of information, but seldom the kind of information that comes from the computer. What kind of information then?

And this brings us over to the national scene and how we try to do something about this particular problem. As in other countries, we have the usual mechanisms for handling information questions: councils, committees, institutes and their respective long-term planning programs. I won't go into that here, but instead mention one aspect of a comprehensive survey of the information needs of engineers in Norwegian industry, which was carried out in 1971.

The results were not, perhaps, very surprising, but something we tend to forget: the practical engineer, the man or woman whose job it is to solve everyday problems in industry, is not interested in what we, the so-called information specialists, like to call information. Which really isn't information at all, but only a reference to something which, with great luck, might contain an item of some informational value. What they really want, and what the survey showed that they look for, is a possible solution to their present urgent and pressing problem. And they need it here and now. Where do they find this answer? Certainly not in a print-out from a computer, not in a 980 page volume of abstract journals, not in high-level R&D reports. They simply ask somebody, like a reliable supplier of machinery, and get at least one answer to their problem, perhaps not the best one but at least an answer and not an academic discussion of all the pros and cons, leaving the problem dangling between the - "on the one hand - on the other hand". Or they ask a colleague, who often has at least a suggestion right at hand or consult the in-house files, the technical handbooks or technical journals. They very seldom make use of the traditional information media.

This of course, does not mean that we should forget the formal information systems, the use of the computer in storing and retrieving bibliographical references, the need for more efficient abstract services etc., but our survey showed very clearly that if we forget that the people we are supposed to serve, look for and want just plain answers to plain problems, then we have failed in our job. It is the balance between the systems and methods on the one hand and a definite answer to a question asked, on the other, that we must not lose sight of.

I think we have to accept this kind of thinking, because society questions more and more openly the justification of continued heavy investments in R&D directed solely towards a purely scientific, technical or industrial goal. But then we have to consider information in an immensely wider context than we have before. The acceptance of this kind of thinking ends forever the idea that the information process is an objective in itself. It emphasizes that information is only one of several tools for making a decision, on the personal, on the company, on the national or international level.

What I see as the ultimate goal for a national I&D policy is to have information accepted as an integral part of a comprehensive decision-making system in a continuous feed-back loop. In such a system, information must be organized so as to be readily available to those who need it in a useful and applicable form. It should be applied to identify and solve priority problems. It should form the basis for the assessment of the net balance of positive and negative effects of applying any specific technology to the solution of any specific problem.

Information will then be integrated in a nation's high level industrial policy deliberations, and end forever the idea that information policy is only an interesting, academic exercise, left to irrelevant theoretical institutions with mental self-gratification as their main objective. Information will then form the true foundation upon which our national science policy must be built.

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Komité for teknisk informasjon og dokumentasjon,  
Norges Teknisk-Naturvitenskapelige Forskningsråd  
ISBN-82-990085-0-6
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(Unpublished report on the status of the Information User project, in Norwegian)

THE SMALL NATIONS' NEEDS FOR SCIENTIFIC AND TECHNICAL INFORMATION:

THE CASE OF NORWAY

Finn Lied  
Norwegian Defence Research Establishment  
N-2007 Kjeller, Norway

1. INTRODUCTORY REMARKS

The title for this talk allows me to select a number of starting points for my considerations. I could have chosen to address you purely from the point of view of an aerospace information specialist, but I have chosen a rather different line of approach which is also a much more general one. Accordingly I will be more concerned with the national policy or strategy for obtaining scientific and technical information than with the detailed structure and technical aspects of information networks.

Knowledge, I think you will agree, should know no geographical boundary, once a new cluster of stars is discovered distant in the Universe, or a new elementary particle, living only minute fractions of a second, is detected - this knowledge belongs to all men, regardless of race or creed, political or social systems.

Through the ages wise men have philosophied on the importance of knowledge. A Norwegian - the Polar Explorer and statesman Fridtjof Nansen - thus once said:

"The history of the human race is a continuous struggle from darkness to light. It is therefore of no purpose to discuss the use of knowledge - man wants to know, and when he ceases to do so, he is no longer man."

I think we all have a deep and profound understanding of the importance of knowledge. History, I believe, supplies us with numerous examples that both man's ability to survive and man's well-being, taken in its broadest meaning, are dependent upon creative intellectual work and progress in technology. We are here faced with a fundamental quality of man which distinguishes him from other higher order mammalia. Benjamin Franklin once said:

"Man is a toolmaking animal"

which by others have been paraphrased to:

"Man is man because he makes tools".

2. TECHNOLOGICAL POSSIBILITIES

Let us study for a minute the results of one such tool which is of particular interest to the aerospace community. We have all seen the beautiful pictures taken from satellites of the Earth as a planet revolving in space. These pictures have had a genuine impact upon mankind. And the pictures also symbolize some of the most important subjects that we will hear more about later at this meeting. I give you only some general key words that I associate with these pictures (however, remember I am not a professional indexer!):

- Photographic techniques
- Advanced communication techniques
- Datahandling and data processing capacity
- Ground stations and communication satellites
- Real-time transmissions

Other pictures, taken by the Earth-resource satellites show, to my mind, in a quite fascinating way what can be achieved by multispectral photography coupled with computer processing. The LANDSAT pictures e.g. show to great sophistication the technological possibilities that already exist, and in which we should take a keen interest. For these pictures one or two key words could be added:

- Computer processing
- Large data volume

Please excuse me for making these slight digressions, they do, however, have important relation to the theme of this meeting as they point to the exiting new technological possibilities which are at man's command.

3. SETTING THE STAGE

The organizers of this meeting has in their information booklet stressed that "The rapid development of new communication techniques, combined with greatly reduced unit costs of communication hardware, has led to easier access to more information for larger segments of the population". With this statement we can all agree, but let us analyze the information problems and information needs in some details.

A large and rich country with an extensive research and development (R&D) activity may have information problems quite different from those of a small nation with limited resources for R&D. I mentioned that the man's accumulated knowledge belongs to all men. In the real world, however, there are numerous obstacles to be free and unbiased flow of information, say between countries of different political philosophies, or inside individual countries between competing industries or research groups. At all levels we may find barriers to the flow of information. Today I will speak only of the open scientific and technical information, and I will not discuss problems associated with obtaining access to classified information.

The information-problems of a small country are many and multifaceted, but before the "needs" can properly be assessed, one ought to take a look at the national goal set forth by the government and other planning bodies. Which political goals have been identified? What ambitions have been set for the industrial level in the country? Which role has science and technology been assigned in the development of the society? What functions are given to the science councils? Etc, etc.

#### 4. POLITICAL AMBITIONS

I will start off by commenting briefly on the political ambitions which to a large degree determines the nation's need for scientific and technical information.

I will use Norway as an example of a small country, it may not be a typical small country, for if we believe the survey published in "The Economist", a year or two ago, Norway will be one of the richest nations in the world. We have already heard today that Norway extends approximately 1750 km from 58° to 71° N, with a coastline of 21 000 km. Most of the population is concentrated in the south-eastern areas around Oslo, but there is a strong desire in our country to try to maintain the present pattern of settlements in the country as a whole. The point I want to make: Information seekers may be situated far from the main classical information centers, such as universities etc.

What are our ambitions in the technical and industrial fields?

In a recent report to the Norwegian Parliament, the Government has staked out its vision for the further development of the industry in Norway. Two prerequisites should be kept in mind, we want to maintain full employment and we must realize that the cost and wage level in Norway is very high, making it difficult for conventional labour intensive industries to survive in international competition.

Norway should therefore participate in a world-wide sharing of industrial tasks and concentrate on a limited number of areas (e.g. high technology areas) where we can draw maximum benefit nationally by using the insight and technological know-how we possess.

I will illustrate this with a few examples. After oil was detected in the North Sea Norwegian firms started experimenting using concrete as building material for the large oil-drilling rigs. This was a new venture for us, by no means a small one, since the platformstructures reach a height of more than 200 meters above the foundation. I think it is also fair to say that Norwegians pioneered in using electronics to monitor the conditions of the platforms as well as their environment. Some of the sensors has to be installed into the rigs during the building phase more than two years before they were put in actual use.

Other areas which are among our industrial "strong points" are e.g.:

- Building of ships for transportation of "liquid natural gas" (LNG)
- Equipment for ship automation
- Building of ferrosilicium ovens
- The electrometallurgic field (e.g. unique production process for magnesium)
- High capacity electric power cables designed to rest on the bottom of the sea (between Norway and Denmark)

These rather arbitrary examples indicate, nevertheless, the ambitions we have. Successful industrial ventures are often based on research at an advanced level. How is R&D then developed in Norway, you may ask. With few universities and small units within our industry it is necessary to try to organize R&D in such a way as to "reduce the problems of being small".

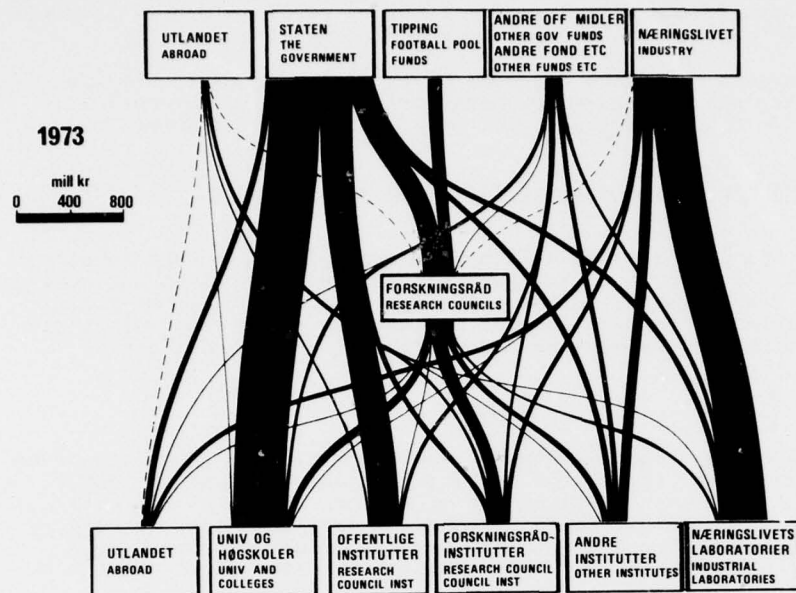
#### 5. ORGANIZATION OF RESEARCH AND DEVELOPMENT IN NORWAY

The basis for our research policy was chiseled out during the first years after the end of the war in 1945. We now have four research councils each responsible for their own research areas. They are:

- The Royal Norwegian Council for Scientific and Industrial Research (NTNF)
- The Norwegian Research Council for Science and Humanities (NAVF)
- The Agricultural Research Council of Norway (NLVF)
- The Norwegian Fisheries Research Council (NFFR)

The Government recently reported to the Norwegian Parliament "On the organization and finance of research". One result of the discussions that followed was the creation or at least a revitalization of a R&D policy board at ministerial level, which one envisions will coordinate our scientific activity based upon a total evaluation of our means and desires. Otherwise the structure was basically left unchanged, but more research will be initiated for solving societal issues.

Norway uses today about 1,3% of her GNP for research and development activity. This figure has steadily increased from 0,9% in 1963. Figure 1 shows how the funds were used for R&D in 1973. Contributors as well as users of the funds are indicated.



Slightly more recent data for 1975 are presented in Figure 2 which shows that government R&D sources amount to 59%, whereas industry contributes by 36% to the total expenditures. An estimated 13 300 R&D man-years were performed during 1975. The heavy involvement by the Government is, to my mind, symptomatic of its keen interest in R&D.

Figure 1 Flow chart of research and development money in Norway in 1973.

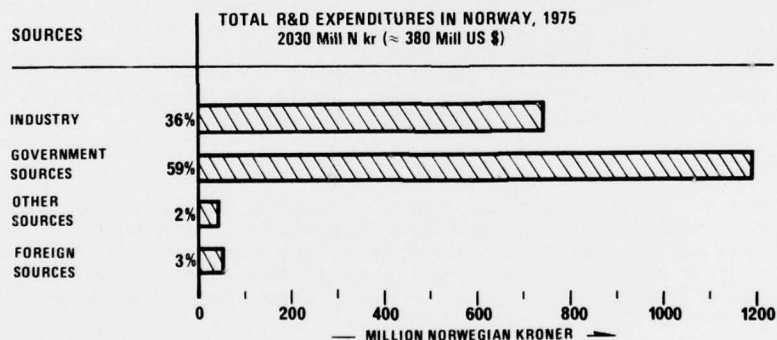


Figure 2 Sources of R&D funds in Norway in 1975.

#### 6. WHAT ARE OUR "NEED" FOR SCIENTIFIC AND TECHNICAL INFORMATION

With this brief and schematic overview of the Norwegian political ambitions and its R&D activity, let us proceed to examine the "needs" for scientific and technical information (STI).

As a small country with 4 million people Norway can never hope to achieve research self-sufficiency nor will this be a goal for us. We are responsible for less than 1% of the total expenditures for R&D in the whole world, and must to a large degree rely on obtaining knowledge from abroad.

Generally, I think that you will agree with my experience that in the fields of excellence - our strong points - all possible information channels should be vigorously pursued. And in these fields Norway will be a source of information for others. Here we have a two-way flow.

Furthermore, in order to ensure that our industry is working on a sound technological basis, and since most of the industries in Norway are rather small, without extensive in-house R&D capacity, it is also a national responsibility to secure relevant R&D

information. The NTNF Research Council through its branch research institutes, e.g. "NSI"-The Norwegian Center for Informatics", have important tasks as do the other research councils.

However, expertise is most efficiently developed during technologically challenging and demanding projects. I believe that Norwegian industry should strive to achieve complete system responsibility in selected areas as part of our nation's cooperation with other countries. License production etc is not equally challenging technologically, and gives less know-how as result.

In passing, let me mention that I also think that we should place more emphasis on what we could call "technological innovators" in our industry, well informed, scientifically and technically educated people who have not lost their creative ability.

After these general remarks there are a number of factors symptomatic of the times we live in, which undoubtedly will increase the need for scientific and technical information for Norway as well as other countries. Let us discuss a few of these, the first is:

#### Scientific and technical information as a basis for sound judgements in politics and in the society at large

A democracy must base its decisions on a firm fundament of reasons and intellectual considerations, taking all aspects of the problems into account. I am not saying that we should be ruled by technocrats; on the contrary, I foresee that our politicians and government officials will demand more of us in terms of working out alternatives etc, to concrete proposals. We must be more efficient in our advisory capacity.

#### Societal issues

Under the second heading - Societal issues - I include e.g. our efforts to develop alternative energy sources, all aspects of pollution in our environment (how to save our lakes and rivers etc). These questions are of concern to all of us, but in contrast to Robert L Heilbroner, the gifted philosopher, I have been able to keep my optimism that we and all the other countries in the world will ultimately be able to cope with these severe problems that many today find so threatening to the future life on our planet.

The path ahead is, however, uncertain, it may well hold in store not only the familiar "four horsemen" (war, famine, plague and civil disorder), but more modern catastrophes as well. It is clear that the world's immediate future will be confusing, complex and difficult to cope with, not least by the erosion of the traditional societal levers, and their replacement by other values, both transient and relatively permanent. No wonder that our future has attracted the attention of technologists, social scientists and historians alike, and that forward projections and prophesis are numerous and conflicting from the certain predictions of doomsday to the comforting picture of flower children enjoying their nirvana. It is our responsibility to provide our political leaders with sound and unbiased information.

#### The age of substitutability

The third and last point, which I will draw your attention to, concerns the abundance, or scarcity of certain materials. Whereas A Weinberg in his essay on "The Age of Substitutability" has demonstrated that materials problems in relation to their scarcity is really only a question of energy, I think we in this auditorium could add "and scientific and technical information". Again a field where increased demand for STI will come, not only in Norway, but in every country.

These three points that I have just mentioned, are only examples of what will be demanded of us in the very near future. For some problems, national solutions must be found. For the majority, however, I anticipate that a world-wide effort is necessary.

We have thus seen that Norway has and will continue to have an extensive need for STI. My reflections so far have been general, having the gross STI problem in mind. Time does not allow me to discuss in depth the various information channels that are available to us in our endeavours to live up to our goals. They range from official channels such as NATO, OECD, UN, etc, to personal contacts between individuals. It is my impression that institutions in Norway have extensive international contacts - although mostly on an informal basis, but we participate in several large international programs, (International Biological Programme, Man and Biosphere, CERN, etc). Our research councils try, within their limited budgets, to secure a representative Norwegian participation in international meetings, congresses, seminars etc. Exchange of scientists for 6-12 months visits are also given high priority.

I feel that I cannot end this introductory talk without briefly mention specifically the field of electronics and its importance to our field. Many years ago Heraklit exclaimed: "panta rēi" - everything is in a continuous change. This is indeed particularly true for our subject matter today. Over the last years we have taken up a new technique, the on-line reference databases. These databases and the datanetworks will be specially welcomed in our country. Searching the published literature before new tasks are taken up in universities or research institutes have for years been a cumbersome job, now it can be done faster, better and requiring less tedious efforts. For our industries searching the data banks on patents e.g. may also be a very worth while job. At my research institute informationsearches will become a requirement before new tasks are started. However, the databases as they exist today are far from the answer to all demands from the users. I would much like to see interactive systems where one could interrogate the databases by asking very specific questions. Also all published material is not of the same scientific or technical quality. A system of evaluation seem appropriate to include with the reference material. And lastly, the published materials appears 1-3 years after the R&D work has been done, therefore active research is the only way of continually keeping abreast with a subject. To be of maximum use the information must be obtained at the right time. I probably do not have to remind you that the lifetime of electronic equipment is about 3 years, before it is outdated as a salesproduct on the market.

There is still one important question that has not been mentioned. I have deliberately not taken up the issue on how we in detail should organize ourselves here in Norway to obtain maximum advantage of the STI sources that exist. This is a complicated and intricate problem. I do want, however, to make one comment on this subject: Whatever solution we decide to go for, we should always remember that it should be technically compatible with the large information systems in the world. Knowledge is universal and I do not think a purely "national" solution in this field is desirable neither from a costeffectiveness point of view nor from the hope of drawing maximum benefit from future technological possibilities. In this field we must adhere to the "principle that the largest users decides", we should, however, not remain silent, but actively voice our ideas to influence others.

#### 7. CLOSING REMARKS

In closing, I assume that we are interested not only in our future, but our history should interest us. You surely recall the heroic deed of the messenger of Miltiades in Greece. He ran from Marathon to Athens - 42 km - to tell the Greeks that they had won. This was important information, and he gave his life to transfer it.

We have come a long way since 490 B.C., but problems still exist, and I wish you success in your deliberations here at Lysebu.

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## INFORMATION 1990, A NORWEGIAN SCENARIO

by

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## SUMMARY

In 1976/'77 Norwegian Centre for Informatics, NSI, conducted a comprehensive study of the possible realistic developments in the field of scientific and technical information in Norway up to the year 1990. Important changes are expected to occur both in production, provision, and use of information as well as in the tools applied for information handling and in the user habits in this area.

The major break-through will be in the extended use of computer on-line terminals, accessing external and internal data bases and data banks providing not only bits and pieces of information, but indeed also adding computer power to the handling and manipulation of these data directly from the office.

Electronic publication will be in its early stages making an impact especially in the scientifically advanced areas of basic and applied research breaking down further the geographical boundaries and the time delay obstacles to the free flow of information.

More time and money will be spent on information for the purpose of making better decisions and keeping abreast of the current developments in science and in business. The leadtime in technological development will consequently be further reduced.

In the information field more emphasis will be put on the quality of information and data accessible, both in content and in presentation. Graphic information and illustrations will be part of the content in data bases and data banks. Confidence limits and other quality stamps will be an integral part of the information provided.

The findings in this study point clearly at a dynamic future information society in Norway with a very strong interaction with the rest of the world. This prospect links nicely to the general industrial policy of the Norwegian government and to our modern history of economic and industrial development in this country.

What will be the development within the professional information field up to the 1990? How desirable are specific possible developments? When are probable developments going to take place? These are some of the general questions put forth to 54 Norwegian professional people, in a Delphi and scenario study made by the Norwegian Centre for Informatics, NSI, in '76/'77. The study was conducted in 4 phases:

1. First a Delphi study with open questions
2. A second Delphi study with 50 detailed and specified questions (when are things likely to happen, and how desirable are the likely developments?)
3. Third round making it possible for the people participating to adjust their answers according to the average response distribution
4. Discussion of results and writing of possible scenarios

The participants in the study were as follows:

	Respondents
- People in industry	6
- Educational institutions	1
- Research and other institutions	8
- Newspapers, publishing houses	1
- Professional societies and organizations	10
- Libraries	4
- Computer organizations	3
Total	33

The final number of respondents are 33 as indicated above, bringing the total response of participants to approximately 60%.

The purpose of the project can be summarized as follows:

- Indication of probable developments
- Bringing together influential people and organizations
- Provide a link-up with possible cooperating parties within the IoD field
- Provide a basis for selection of research projects in the IoD field
- Collecting insight into the local scientific and technical information problems and possible comparison with international developments

The motivation for this study can be summarized in 3 points:

1. Preparing the Norwegian professional sector for the "information society"
2. Making it possible to select the major influential factors, leaving the unimportant factors aside
3. Providing a specification of the future possibilities and threats within the IoD field

#### NORWEGIAN BACKGROUND AND STATE OF ART

The technical prerequisites are available to develop extensive information systems via telecommunication with a large number of users throughout the country to:

- Provide information from an increasing number of national and international data banks and data bases
- Give access to and supplement local computer capacity with resources from large regional or central computer facilities
- Develop new means of contacts between businesses, organizations, public offices and individuals
- Use existing systems by means of relatively inexpensive hardware without having to consult experts in utilizing these systems

The development has opened the possibilities to get increased access to existing information and the production of new information to an extent which is an order of magnitude greater than previously. As these possibilities are being exploited the consequences will be of great importance to the production and social structure in this country. One underlying problem is the gap between the "information rich" and the "information poor". This unhappy situation is in conflict with the official government policy of

- Maintaining and developing a diversified and geographically desentralized industry
- Trends towards developing "intelligence industry"
- Desentralization and democratization in industry

Developments within the computer technology field can be used to intensify developments in this policy direction. The price of computer equipment is rapidly decreasing. Computer and software systems can now be designed for use by laymen without the need for intermediary specialists. New methods for system description, project organization and programming has made it possible for the user to participate actively in the development of edp systems. However, when new technology and new methods for using this technology has been emerging, some time will have to pass before easy-to-use edp systems will be everybody's prerequisite.

For the time being Norwegian on-line terminal users are applying the public telephone network for their transmission purposes. In Scandinavia Norway cooperate in the SCANNET information network between the Nordic countries. As projected for 1979 the public telecommunication system will open the public data communication network (NPDN). In this network any user can reach all destinations within 0.1 second.

The official development seems to be in the direction of distributed data networks. In this set up the computing and storage capacity will be distributed between the users own equipment and the hardware accessible through the data network. One can expect a future development of new demands for data processing and communication, like text handling and distribution of messages through the data networks.

The information situation for the small users of external information is today that they have no access to data banks and keep abreast of developments through personal contacts, journals and publications. Extensive work is now done to make information in the form of bibliographic and fact data bases more easily accessible. In a general sense the small user is not able to benefit from these systems today.

A necessary step forward is to make the international information services available to the small users through a network facility. In order to accomplish this task the services must be adapted to the small users need both in respect to his economic capability and his ability to handle professional information.

To sum up so far, the present situation can be described as a starting point with a strong need to develop systems and start processes to strengthen the "information poor" units within industry, organizations and public administration.

Some conclusion from the Delphi study:

Significant changes will occur in the distribution of professional information in the years to come. The need for efficient and fast access to information in research and industry will be greater than ever. This need will be realized within the professional companies and institutes in such a way that the organizations will allocate a larger proportion of their budget to acquisition and use of professional information.

The physical changes to occur will be dominated by the broad introduction of the on-line terminal. The important invisible factors are the accessibility of data bases and data banks of different content, making the use of the on-line terminal towards these information resources highly profitable. These factors will be looked upon as the major elements in the information revolution ahead of us. This future will consequently make it much easier to find the information one is after for problem solving and making relevant decisions. The use of these information systems will be a daily routine for most professional people. Consequently people will use more of their time in the utilization of existing information resources. The knowledge and proficiency in use of these systems will strongly activate the demand for this type of information services. Therefore, a dramatic increase in the number of on-line terminals is foreseen in business, research and public offices.

Our imagination seems to be the only limit to the number of different data bases and data banks which will be available for on-line use. Technical reports and research information will be just the tip of the ice-berg. Product information, business information, government laws and regulations, social information, financial information, stockmarket notations, tourist information, as well as imaginative games and simulation programs will also be available along with standard computer software for specific purposes, technical computations, accounting programs, financial analyses, and many more will be in on-line use, for a relatively small fee.

In a study conducted by the Norwegian telegraph administration "Study of the need for tele-services in homes", report number 19/76, the following conclusion is drawn:

"Selecting information from data banks" has a built-in wide variety of choice and presupposes the use of the telephone network. The service will be available in the period 1985-1995 and its potential is some 35% of the private families, using the service 1.5 hours per week, paying somewhat more than 30,- 1976-kroner per month for its use. The service is particularly desirable for the below-average age groups."

Terminal-to-terminal communication will make it possible to activate the personal communication between professional people. International available information sources will be accessible at about the same price as the local and national information sources. A built-in reference service will point the information searcher to the sources which eventually can answer his problem. Graphical information and pictures will also be transmitted on-line together with figures and verbal descriptions.

The fascinating development in use of on-line terminals and computers will strongly reduce the need for paper as a medium for transmitting information. Relatively speaking this is the road towards the "paperless society".

Scientific and technical results and discoveries will very fast be transmitted and adopted by industry and the professional society. It will be possible for scientists and engineers to subscribe to reports of titles which fall within a specified personal profile stored in the on-line network. This will be an alternative to the more conventional subscription on a journal, and as a consequence the subscriber pays only for the information of high relevance to him. This use of "stored profiles" will make it possible to adopt more selective information services.

As a consequence of the versatility of the on-line terminal the information systems will be highly sophisticated and at the same time more user-oriented. Improved terminals and simple user routines have led to the development of information systems with a minimum of keyboard operations. Within 1990 at least 80% of the professional people in industry and research will have on-line terminals available in their offices. The drive for easy operation has led to the use of the natural language for retrieval and distribution of information. Never-the-less, thesauri, synonym tables, and other search tools will still be important tools in the on-line systems. English is the predominant language, as more than 90% of the on-line information systems will be based on this language.

Some of the greatest successes in the on-line systems will be the construction and utilization of personal information banks. More and more people transform their personal archives into information files in electronic form. This personalized information and data can be manipulated by standard edp programs for statistical and mathematical analysis.

The use of data terminals for personal conferences and meetings is beginning to develop in 1990. As a consequence there is a certain reduction in the number of meetings and conferences. Some developments which up to now have been considered probable developments will not have taken place. Despite easy access to sources for language translations, and even easy access to machine translation, there has been no substantial increase in the use of professional literature from sources outside Scandinavia and the English speaking part of the world. Neither will there be any remarkably reduced demand for printed indexes and abstract journals.

The impact of on-line technology in 1990 on other aspects of the information handling in Norwegian companies has not been as important or progressed as fast as many had expected. Large gains have been achieved in the utilization of a large number of external information sources. The on-line systems have up to now had relatively little influence on the way internal information is handled, and on the way industry is communicating with external organizations. Internal reports and memos will still be in paper form. There is no indication that on-line communication will take over the handling of technical and commercial correspondence or that the terminal-to-terminal contact within an organization or between organizations has led to substantial reduction in the use of the telephone.

In 1990 the use of on-line communication in Norway will be strongly oriented towards professional communication. There will not be an extensive use of on-line terminals in private homes, despite the fact that all equipment for these purposes will be easily available.

The future in the information sector lies in the fact that the technical possibilities - the tools - will undergo a revolution, making it possible that knowledge and data in all forms will be easily available. This will effect the working situation in a positive direction - it will be easier for professional people to work. Even if we cannot expect that man can change his intrinsic ability to use information, never-the-less it is soothing to know that information will be at hand.

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SCANNET - EURONET

(Aims, policies, organization,  
services and impact expected)

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## INTRODUCTION

SCANNET and EURONET both attract attention due to the elements of political issues around their design, configuration and expected impact.

Systems and technology chosen for these networks are well-known from other computerized I&D-systems in operation, but what makes SCANNET and EURONET distinctive - and are they equal in principle, and are they compatible?

Having participated for some years in I&D-policy forming committees - in Denmark, at Nordic level, at European Economic Community level and at OECD level, the author wants to discuss and review networks and systems in general and SCANNET and EURONET in particular for their contributions in the fostering of the economic and social evolution.

View-points and evaluations offered are not necessarily shared by all authorities involved with the design and the configuration of the networks, but being dynamic attempts there may still be a need for clarification of measures of importance.

The theme of this meeting is in the programme identified to be a review of the main trends in communication and information technologies - and I guess this is meant to be a review from a scientific and technical point of view.

But it is further mentioned that the review should put these developments in a broader perspective of national and/or regional policies.

The author has the understanding that trends, observed to-day, are results of past activities, influenced by actual conditions - and objectives of the future are set as a combination of experience, present knowledge and imagination, adjusted by policy issues concerning desirable values, and methods of obtaining these values.

Assessment is a process by which achievements in real life are used to measure and evaluate scientific activities and results for their appropriateness - for their successes and for their failures.

A review of networks as SCANNET and EURONET - both involving elements of political issues - must have a wider perspective than when reviewing networks and systems just serving scientific, technical and business purposes.

A review of the main trends within the field of I&D during the last 30 years provides indications that trends are very much influenced by political issues - by Government demands.

The 1940ies - 1950ies were decades when great efforts were devoted to the re-establishment of "the lost economy" by productivity drives - "share your knowledge and experiences".

The 1950ies - 1960ies were decades when Governments believed that great investments in science and technological research as well as education would conclusively lead to dynamic economic and cultural progress.

The "man-to-the-moon" project proved that effective retrieval of knowledge already gained could contribute the greatest part of the total amount of knowledge applied for the achievement of the successful result.

The 1960ies - 1970ies are the decades when the human race universally and the Governments are realizing that "betterment for mankind" can only be obtained through putting knowledge into operation - by converting knowledge into practical progress - i.e. improvements and innovations of any kind in enterprises of the private and the public sector.

This really means that Governments expect the professionals within our field to add some parameters of social and economic values to our "scientific and technical" assessment structure.

We all remember that the National Science Foundation in the US strove very early for establishing an advanced National network covering all American States, but that NSF had not too much success due to different political issues - and only when business and management oriented systems and services as Lockheed and S.D.C. were introduced, we got a break through.

By these introductory remarks I want to indicate the trend in political issues on goals for the future, which we have to accept and which we have taken into account when designing networks in Scandinavia and within the European Economic Community, because I&D-services here are merely public utility services financed to a great extent by public grants.

An I&D-policy - national and regional - and consequently the resulting infrastructure of I&D-services - must therefore include

- gathering, evaluation, storing for retrieval, offering accessibility opportunities for the scientific and professional user familiar with sophisticated systems and equipment,

but must also include

- the interfacing of the ultimate user - and very often end-users remain potential users - with professional mediators having the understanding of, the knowledge of and the practical expertise in how to profit from "banks" of bibliographic and factual data.

Assessment of I&D-services - of systems, communication and equipment - has the aim of evaluating, how well the services are contributing to the final political goal - the economic and social evolution.

The attempts to establish SCANNET and EURONET are based upon - directly or indirectly - political issues and will.

This has a major influence on the design and on the formulation of a number of basic outlines.

To foster the economic and social progress of the respective regions and of their member countries, the networks must be open and distributed - with regard to distribution of access-points to the networks and with regard to establishment of user-terminals and qualified mediator-services, as well as with regard to host-computers offering services from their - more or less specialized but unique - "banks" of bibliographic and factual data.

Discrimination or less fair conditions of national, professional or economic nature are not acceptable.

The aims of the network are two-fold: to ensure a wide-spread growth of capabilities and competence and to ensure maximum effectiveness in benefit from the utilization of the network-services offered.

A basic philosophy has been to develop an effective communication of I&D by a voluntary cooperation between resources already in existence, to harmonize and rationalize activities in existence and to stimulate and fill in where gaps exist.

Both networks consist of three parts.

A technical part : the national "access-points" (switching nodes or remote concentrators) linked together by telecommunication lines.

A substantial part: a structure of databases (bibliographic or factual) mounted on host-computers.

A cliental part : a geographically and professionally (also by level of competence) widely distributed target group of terminal-users.

With regard to the technical part, it became obvious from the first moment, that the initiators had to cooperate very intimately with the Government-owned P.T.T.'s, and that the I&D-community could only do that on a contractual basis.

The nine P.T.T.'s of the EEC-countries formed a consortium, electing the French P.T.T. as their spokesman. A contract has been signed between the P.T.T.-consortium and the Commission of the EEC for the establishment of 4 switching nodes at Frankfurt, London, Paris and Rome and 5 remote concentrators in Amsterdam, Brussels, Copenhagen, Dublin and Luxembourg, plus leasing of telex facilities connecting the national entrance points. The physical network is designed for a packet-switching technology. The cost of traffic on the network is to be borne by the EEC during the experimental phase.

With regard to the network for the Nordic countries the initiator of SCANNET, NORDFORSK, signed a similar contract with the Swedish P.T.T. on behalf of the Scandinavian P.T.T.'s for the establishment of concentrators in Copenhagen, Gothenburg, Oslo, Stockholm and Helsinki and leasing of telex lines connecting these concentrators. The conditions were about the same, leaving in both cases the P.T.T.'s empowered with the technical and management responsibility and control of the technical part of the network.

That the networks, with the chosen configuration, are semi-public, means - that of course the P.T.T.'s need to have authority, with regard to acceptance of who and with what qualifications and conditions are host-computers going to offer their services on the network (the qualitative and quantitative control with the second part of the network), and who and with what qualifications are users using the network and for what purpose (the qualitative and quantitative control with the third part of the network).

Of course this means a certain standardization of equipment, of user manuals, of tariffication, but it also leads to restrictions to the effect that the telecommunication lines cannot be used for non-professional conversations between terminals and between terminals and service centers.

While the management control of the physical configuration of access-points and telex lines plus of the traffic-load has been delegated to the P.T.T.'s, together with the responsibility for the technical quality of the communication, - the management of the substance on the networks and of the effective use

of the substance and the accessibilities still remains with the initiators, - and that is important, - and that calls for excellent management.

Who are the initiators, and how do they arrange their management?

May I - as we are in Scandinavia - deal first with SCANNET.

There are old traditions in the Scandinavian countries within research library, documentation and information services.

As we are of the same breed and are understanding each others languages, there are also old traditions in cooperation - even if it often takes the same shape as within any other "family of sisters and brothers" - no one should have the feeling that he or she is better, is more clever or is more powerful than any of the others.

Some of you will remember that years ago the Scandinavian Governments had the ambition of forming NORDEK, an economic integration, but failed. Only one body was left - cooperation in I&D - named NORDDOK - a joint policy committee financially supported by the Nordic Cultural Fund.

At about the same time the Ministers for Finance and for Trade and Industry launched their idea of the benefit by having a common, public data network developed, suggesting the "neutral" area of scientific and technical documentation and information as being appropriate for gaining the necessary experiences.

The road to implement such a fancy idea is long - long and filled with fences, barriers and traps.

Only when NORDFORSK (the Scandinavian Council for Applied Research) by its I&D-Committee in 1974 introduced the configuration of an open and distributed network - the project was approved.

You probably know that NORDFORSK is a joint body of nine Governmental Research Councils and private Academies of Technical Sciences.

After 2 years of technical preparation NORDFORSK reached at its meeting the 2nd June 1976 to the final approval and support of the SCANNET experimental project and guaranteed the cost of the technical part of the network for the period up to 1st January 1979.

NORDFORSK signed the contract with the Scandinavian P.T.T.'s and established a SCANNET Steering Committee and a SCANNET Technical Committee which are responsible to NORDFORSK in an executive capacity within a certain frame of budgets.

As it was evident that such a major project would have an impact on and importance for the various national policies and for the development of the Scandinavian policy for I&D, the preparation for and the mandate of the SCANNET Steering Committee included the injunction on and the utmost importance of any advancement of plans and of steps of execution having to be consulted with the national I&D-policy committees (DANDOK, NORINFO, SINFDOK, TINFO and NRC Iceland) as well as with NORDDOK (from 1st January 1977 succeeded by NORDINFO).

By these measures NORDFORSK ensured maximum professional and moral support during the development and the implementation of a network for which it was evident that if becoming a success the financial and professional grant should be taken over by Nordic Government authorities as per 1st January 1979.

The experiences of the network operations would have the interest of the Ministers for Finance and for Trade and Industry and the P.T.T.'s, just as the experiences with the mounting of substance on the network and with the development of a distributed target group of terminal users would have the interest of NORDINFO and each of the national I&D-committees.

NORDDOK has - and NORDINFO will - devoted most of its efforts and funds to support the development and the connection of international, regional and national databases to SCANNET, at the same time as it will stimulate and train potential and actual users in effective utilization of the total facilities of SCANNET.

SCANNET is in operation, and even if few databases are at present accessible on SCANNET, the benefit to the sector of science, research and education is already evident. The major value for industry will depend upon, when and how many databases of interest to industrial and business operators are made accessible.

With regard to EURONET I personally find the situation to be much more complicated.

Even if there is common agreements on aims and basic principles, the measures of the individual member countries of the EEC with regard to I&D-policies are so different - just as different as the combined economic and political power the individual country is able and willing to put behind their request for common approval of their own specific measures.

As far back as in June 1971, when the EEC Council of Ministers decided on the creation of CIDST (The Committee on Information and Documentation for Science and Technology), the basic idea was to coordinate the efforts of the member countries of the EEC within the I&D-area.

In March 1975 the Council of Ministers of the EEC adopted the first Action Plan in the field of Scientific and Technical Information which plan had the creation of EURONET as its primary objective.

The physical network will be financed by Community funds up to the end of 1977 and hopefully also during the period of the second Action Plan 1978-1980.

While the major principal measures for SCANNET and EURONET are the same, EURONET is faced with more complications to be clarified, compromises to be made, steps of harmonization of national policies to be taken.

While SCANNET can adopt three national languages to be used, with a tendency of giving preference to English as a working language, EURONET is faced with a demand for cheap facilities for multilingual handling of information.

While SCANNET has no need for duplication of databases within the Scandinavian area, there may be reasons within EURONET to arrange such duplications. These reasons may originate from requests for a better traffic-distribution on the network but may also be due to national policies and national prestige.

Whatever the reasons are, they complicate and delay negotiations on the establishment of EURONET.

Communication charges should for EURONET, as for SCANNET, be equalized, irrespective of distance in order not to penalize the more remotely placed users.

Service charges should for EURONET, as for SCANNET, be related to costs, and protective and competitive subsidies should be avoided.

Having discussed and evaluated a number of such measures over the past years time seems to have come where further progress of EURONET needs a clarification of the management structure, with regard to the substantial and the cliental part of EURONET, and for the conditions of these partners for contribution to and benefit from EURONET.

It is of major importance for the member countries of the EEC to share voluntarily their resources of knowledge and competence - having the long-term objectives of a wide distribution of upgraded capabilities - having the short-term objectives of effective utilization for practical progress of the capabilities established somewhere in the member countries.

These are the objectives for SCANNET too.

Developing along the same lines these networks must be linked with each other in a not too far future and by this process form a prototype for further linking up with other networks having similar aims and configurations.

Recognizing at international and at regional levels I&D-services to be major resources for fostering the economic and social evolution, national Governments may easily come to the conclusion that full benefit of networks as SCANNET and EURONET can only be obtained when national access-points are extended to a national network distributing access-points with attached mediator-services widely within the national boundaries.

Many potential users - especially small and medium-sized enterprises - will only be able to benefit from the network facilities through a person-to-person interfacing activity - so-called technological information services characterized by their ability to diagnose needs and demands for information, the existence of which the potential end-user not even knows of.

For further information

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 Grev Turegatan 19  
 P.O.Box 5103  
 S-102 43 Stockholm  
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 telephone: 08-141450
- on EURONET: COMMISSION OF THE EUROPEAN COMMUNITIES  
 DG XIII  
 Directorate General  
 Scientific and Technical Information  
 and Information Management  
 Building Jean-Monnet  
 Kirchberg - LUXEMBOURG  
 telephone: 43011

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The Future of Primary  
Scientific Publications

by

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The problems and drawbacks of present-day primary literature are well known:

production, distribution and storage of journals are expensive;

the individual reader is interested in only a small fraction (5-10%) of the papers printed in a journal;

it is only by using the secondary literature and in particular its indexes (conventional or machine-readable) that specific access can be gained to papers of interest;

nevertheless, primary and secondary literature are produced in two independent and uncoupled processes which causes unnecessary expenses and delays;

primary journals serve two distinct purposes, i.e. information dissemination and information storage, and consequently cannot be modified to serve each purpose in the best possible way.

In order to overcome these difficulties and to improve and accelerate the flow of scientific information, an integrated publication system is proposed, whereby full papers are published in microform only. For each paper entering the microform store a synopsis of about one printed page is published in the classical way, i.e. in a synopsis journal. Of course, papers will continue to be refereed before they are accepted for publication. Microform is offered to libraries for subscription, since it is impractical and undesirable for several reasons to establish "manuscript banks" or "depository libraries". Such institutions would impede rather than enhance the flow of information.

The synopsis journal is directed to the individual scientist. Its sole purpose is to provide for information dissemination and to allow for browsing. Synopses contain enough material (including display items) to tell the reader the salient points of the full manuscript and to let him decide whether or not it is worth his time to deal with the complete account. If need arises, he will find the full text in microform (which serves the purpose of information storage) in his library.

Since the system provides two distinct tools for information dissemination and storage, it is flexible and its components can at any point in time be adapted to the needs of authors and readers and to progress in information transfer technology.

As regards information retrieval, bibliographic files (i.e. indexes) and data banks are suitable tools. Preparatory work for their production should be made while a paper is being processed for inclusion in the synopsis-plus-microform system in order to speed up the availability of information and to cut present-day expenses which are unnecessary in terms of information flow.

Experiences with the synopsis-plus-microform system have been gained since 1974 with the German journal Chemie-Ingenieur-Technik. The Chemical Society of London has investigated the feasibility of the system in other areas of chemistry. Based on these experiences and investigations, the chemical societies of England, France and Germany have decided to launch a synopsis/microfiche journal in the field of chemistry as a joint venture in January 1977.

Innovations in Information Transfer:  
A Program to Stimulate Change

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SUMMARY

About three years ago, a program to stimulate the introduction of beneficial change into the scientific and technical communication process was begun. Concentrating initially on the primary dissemination component of the communication process, a guidebook for innovators has been produced and distributed. Various activities to expand the guidebook, encourage the utilization of its contents, and evaluate its usefulness have also been undertaken. The program experience and results to date are discussed, and plans for expanding the program into other areas of the STI communication process are outlined.

THE ORIGIN OF THE PROGRAM

In June of 1974, Capital Systems Group began a program intended to stimulate the introduction of innovations into the scientific communication process. This project was originated and funded by the Division of Science Information (then the Office of Science Information Service) of the National Science Foundation.

The purpose of this program was to develop and implement a mechanism, or cluster of mechanisms, for informing persons who influence the communication process about new ideas and techniques that they might use to improve the transfer of scientific and technical information (STI).

The program was founded on several basic premises, namely that:

1. Technological developments are rapidly opening up new channels and concepts of scientific communication, as well as making possible the improvement of existing conventional methods of communication.
2. Inflation, shrinking library budgets, and other economic factors are forcing the producers of scientific and technical information to find more cost-effective ways to provide their services and products.
3. Successful methods for communicating in fields other than science and technology can often provide models that can be adapted to scientific communication.
4. An active, continuing effort to collect, evaluate, and disseminate innovative ideas between the originating sources and potential beneficiaries is needed.
5. There is no established mechanism effectively transferring innovative approaches to scientific communication to organizations and individuals in positions to employ them.

What we have accomplished and what we have learned during the three years this program has been in operation is the subject of this paper.

A GUIDEBOOK FOR INNOVATION IN PRIMARY DISSEMINATION

In order to limit the initial project effort to manageable proportions, it was decided that we would first concentrate on innovations applicable to formal primary dissemination--in other words, to the original publication of research information and scientific findings, usually in scientific journals and technical reports. Consideration of innovations in other areas of scientific communication--such as secondary publishing, information gathering and use, and informal communication--was to be deferred, at least at that time.

A looseleaf guidebook, which could be easily updated and revised, was selected as the best vehicle for describing and disseminating innovative ideas to prospective users. Our early analysis suggested that the principal users of such a guide would be scientific journal editors, executive officers of professional societies, and key personnel in various governmental and industrial organizations that produce scientific and technical reports. University presses and major scientific and technical organizations in other countries were also seen as potential users of the guide.

A comprehensive literature survey was undertaken with three objectives in mind:

1. To identify specific innovative techniques and concepts applicable to the primary dissemination of scientific and technical information;

2. To identify articles dealing generally with innovation and technology transfer applicable to scientific communication;
3. To identify organizations and individuals likely to be innovators in scientific communication.

This literature study turned up very little information dealing specifically with innovations in information transfer, and even less dealing with the general subject of innovation in scientific communication. These results reinforced our initial intuition that the actual identification of innovative ideas would be by far the most difficult single aspect of our undertaking. However, the literature search did yield a significant list of organizations and individuals who appeared to be either innovators or knowledgeable about possible innovations in scientific communication. It also provided a very comprehensive list of periodicals containing information, mostly technological, that could be scanned routinely for new products and services that might be useful in scientific communication.

A technical advisory committee, composed of experts in various aspects of scientific communication, was established to assist the project staff in the early stages of planning the guidebook and the procedures by which it would be developed. With the assistance of this advisory committee, the project staff evolved a provisional structure for the guidebook and a plan for gathering and compiling various types of innovative ideas concerning the primary dissemination of scientific and technical information.

We then embarked on a multifaceted information-gathering effort. Inquiries were addressed to individuals and organizations in the United States and other countries who were known, or expected, to be involved in innovative approaches to communication. These inquiries requested information about known innovations and requested referrals to other individuals and organizations we might contact concerning possible innovations. Over 900 such inquiries were sent out during the initial data-gathering process. The project staff personally visited approximately 60 organizations known to be actively engaged in innovative programs. We monitored trade journals and professional publications for additional information and ideas. The staff also attended numerous equipment exhibitions and professional meetings concerned with improving the dissemination of scientific information. Finally, we placed press releases, describing the nature of the project and requesting submission of innovative ideas, in over 100 periodicals dealing with scientific information, publishing, processing, and cognate subject areas.

The information acquired was reviewed by the project staff for relevance and significance. Through this process, candidate innovations for the guidebook were selected. After about nine months of data gathering and analysis, we had selected about 130 such candidates. Through a process of further refinement and consolidation, about 90 candidates were finally selected for initial publication, and a standard descriptive entry, or profile, was prepared for each innovation.

A special review panel, consisting of scientific journal editors, government information officers, and academic press representatives, was convened to review the draft manuscript for the guidebook. With the help of this review panel, further revisions and refinements were made and the Guide was scheduled for publication.

The contents of the Guide are subdivided into categories according to the nature of the innovation involved (See Exhibit 1). Slightly more than half of the Guide is devoted to innovations that could be used to improve conventional publishing. The remainder deals with the creation of by-products; print-on-paper alternatives; non-print-on-paper and mixed media innovations; trends and prospects in communication innovations; and needed innovations.

The main body of the Guide consists of short descriptive profiles of innovative ideas, accompanied, where appropriate, by graphic illustrations and a brief discussion of the possible applications of each innovation, plus some of its advantages and limitations. A sample Guide entry is shown in Exhibit 2. The Guide also includes a glossary of special terminology and a list of suggested sources for additional information.

The entries have been written in a conversational, nontechnical style to make them most readable and intelligible to a wide spectrum of possible users. The objective has been to present the essence of an innovative approach, with enough information to allow the reader to decide whether or not he or she is interested in pursuing the subject further. We have deliberately avoided any attempt to provide enough information in the Guide for readers to apply its contents without further guidance and more up-to-date information. We have also avoided identifying the sources of innovative ideas, in hopes of minimizing the burden that might result from numerous inquiries stimulated by the Guide, on organizations heavily involved in innovative programs. Instead, readers are encouraged to contact our project staff, which serves as a central clearinghouse for further information. Often, we are able to answer readers' questions from our own experience or extensive reference files. If we cannot, we refer the reader to one or more source organizations as appropriate.

Two thousand copies of the Guide were published in October of 1975, about 15 months after the inception of the project. A concerted effort was undertaken since that time to place the Guide with individuals who, by virtue of their organizational affiliation and responsibilities, are in a position to introduce innovative change into primary

# EXHIBIT 1

## CONTENTS (Condensed from Original)

Introduction

Production of the *Guide*

### I. Innovations in Conventional Journal and Monographic Publishing

1. Capture and Recording of Information
2. Editorial Processing
3. Publication Design
4. Composition
5. Reproduction
6. Distribution
7. Marketing
8. Market Research
9. Organization and Management of Operations
10. Cost-Control, Pricing, and Financing
11. Creation of By-Products

### II. Print-On-Paper Alternatives to Conventional Publication

### III. Non-Print-On-Paper and Mixed-Media Innovations

### IV. Trends and Prospects

### V. Innovations Needed

Appendix

Glossary

Suggested Sources of Additional Information and Data

## EXHIBIT 2

### Sample GUIDE Entry

#### TELEPHONE-ASSISTED REFEREEING OF JOURNAL ARTICLES

##### Description

Telephone contact between the editorial office and referees customarily takes place after the reviewer has a paper in hand. In "telephone-assisted" refereeing, however, the telephone is used to speed the assignment of manuscripts to reviewers, and to accomplish part of the review process.

The editorial office maintains the usual file of referee names, addresses, and areas of interest. When a manuscript arrives at the editorial office, central-office personnel search this file until they come to the first referee whose interests appear to match the content of the paper. They telephone this referee, and read to him the paper's title, abstract, and any portions that the referee thinks necessary to determine (a) whether he is the appropriate person to review the paper, and (b) whether the paper should be given further review, or rejected out of hand. If the referee feels that he is not competent to judge the paper's merit for further review, he is asked to name someone who is. The editorial office then contacts the suggested individual, who is added (if necessary) to the file of reviewers. In this way, papers are not sent to reviewers who are unable or unwilling to review them. At the same time, the group of reviewers available to the journal is continually and conveniently expanded.

##### Benefits

The principal benefit of this approach to refereeing is that it speeds the review process considerably. One organization that adopted this practice found that the time required to have papers reviewed dropped from 2-4 months to 2-4 weeks. Secondly, this approach should improve the quality of reviews, because referees deal only with papers in whose contents they are interested and competent.

##### Problems and Limitations

The obvious limitation is the expense incurred through long-distance telephone calls. This may be substantial, but must be weighed against the costs of processing manuscripts entirely in the traditional way (which may be greater than one would imagine), and against the value to the publisher and his constituency of the more rapid processing of manuscripts.

##### Applicability

Telephone-assisted refereeing would be most appropriate for journals that deal with large numbers of manuscripts, do not have sizable backlogs, and publish in a variety of disciplines or sub-disciplines. These are likely to be large, broad-interest journals. In the case of smaller, more narrowly focused journals, referee assignment is likely to be less problematic. Also, the problem of unrefereed manuscripts accumulating is likely to be less severe.

##### Management Considerations

No special equipment, training, or personnel would be required. The editor would want to inform his reviewers of the change before implementing it. Access to the editor's files of reviewers would be necessary for the editorial personnel who ordinarily handle correspondence with reviewers. In essence, the change would merely involve conversion to the telephone for communications previously handled by mail.

4/15/75

scientific communication. Each such person has been provided with a gratis copy of the Guide and placed on the distribution list to receive updates as they are produced. To date, nearly all of the 2,000 copies of the Guide have been distributed. A profile of the recipients is shown in Exhibit 3. The largest class of Guide recipients represents society executives and professional journal editors. We contacted these individuals through an extensive direct-mail effort intended to reach every scientific society in the United States. It should be noted that each individual who has contributed innovation information to the Guide project has also received a copy in hopes of encouraging further contributions from innovators.

To date, four updates have been produced and distributed to holders of the Guide. The most recent updates have included short tutorial descriptions of new technologies concerned with such subjects as phototypesetting and the application of word processing to scientific publishing.

Each recipient of the Guide is also furnished with an evaluation form, to be returned to the project staff after the recipient has had an opportunity to review the Guide's contents. Approximately 15% of the Guide recipients have returned the evaluation form. From these returns, we can gauge users' opinion of the Guide's contents, together with their suggestions for reviewing and refining its contents. To date, the user reaction has been quite favorable. On the basis of a 5-point perfect score, the Guide has received an average rating of over 4 on both the substance of its contents and on the manner of its presentation.

Copies of the Guide have also been placed with the National Technical Information Service, to provide access for interested individuals and organizations who cannot qualify for direct subscriptions.

The lessons we have learned from producing the innovation Guide can be summarized as follows:

1. It is extremely difficult to identify innovations. Often those who have taken an innovative approach do not perceive it as such, or no longer consider it novel. On the other hand, many things put forth as innovative tend to be self-serving and not of any truly general consequence.
2. An active, continuing effort is required to seek out innovations. Once the Guide was published, we hoped that many recipients would voluntarily suggest new innovative ideas, thus creating a self-perpetuating communication mechanism. However, that has not occurred to any great extent.
3. Communication technologies have not yet had quite the impact on primary dissemination that the casual observer might have expected. Many of the innovations that we have been able to identify involve nontechnological changes.
4. A small number of organizations, primarily societal publishers, stand out as major innovators in primary dissemination of scientific information. These organizations seem to possess the necessary combination of staff motivation, technical sophistication, and organizational commitment to conceive and introduce novel approaches and changes to the status quo. Most other organizations lack a positive inclination to introduce innovations, and only do so when forced to respond to economic considerations. The strongest influences discouraging innovations are chiefly: tradition, the inevitable resistance to change of a society's membership, and the governing structure of societies.
5. Finally, we have confirmed, at least to our satisfaction, that current methods of primary dissemination in science and technology offer much opportunity for innovative refinement. This potential will probably increase significantly in the years ahead as the impact of both new technologies and new communication concepts becomes ready for practical application.

#### FOLLOW-THROUGH ACTIVITIES IN PRIMARY DISSEMINATION

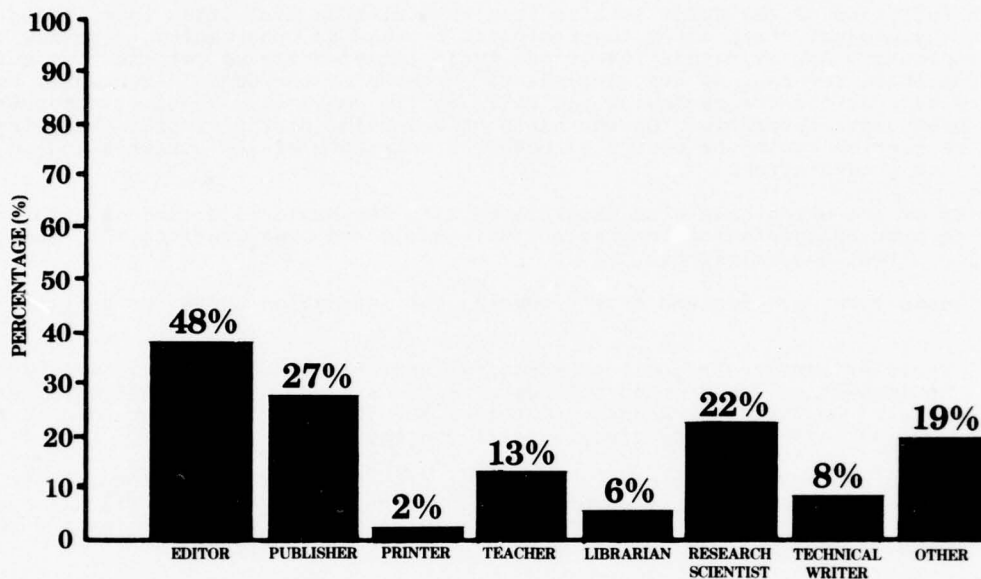
With the initial production of the Guide completed, a number of additional activities have been undertaken:

1. Development of New Guide Entries - An active effort is being maintained to prepare new entries for the Guide; this includes visiting and corresponding with known innovators, scanning the literature, and attending equipment exhibitions and professional meetings.
2. Additional Dissemination - Additional individuals who are in a position to put the Guide's contents to productive use continue to be sought.
3. Analysis of User Feedback - The questionnaires and comments returned by recipients of the Guide are continually evaluated by the project staff in order to find ways to improve the Guide and increase its value. In addition, the Advisory Panel has been reactivated to provide continuous critical evaluation of the project.

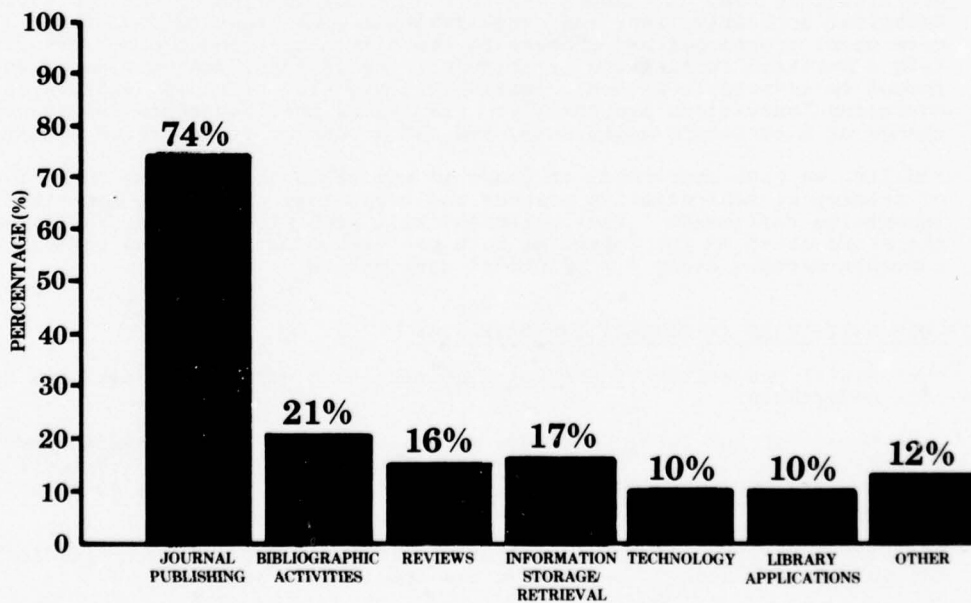
## EXHIBIT 3

### PROFILE OF GUIDE RECIPIENTS\*

#### BY PRINCIPAL OCCUPATION:



#### BY MAIN INTEREST IN SCIENTIFIC/TECHNICAL COMMUNICATION:



\*This profile was prepared using information from the questionnaires returned by only a portion of the Guide's recipients; however, we feel that this sampling and the resultant percentages are representative of Guide recipients as a whole. (Computations were carried to the first decimal and then rounded appropriately.) It is also important to note that there are overlaps between categories as many questionnaire respondents indicated more than one occupation or interest.

4. Technology Stimulation - We have developed a plan for convening panels of experts to assess the state of critical technologies and to identify technological barriers to improving communication, and preliminary working meetings have been held to assess the technologies of word processing and photocomposition.
5. Reference and Clearinghouse Service - The project staff is acting as a central referral point for Guide users who are interested in obtaining more information about innovations that they might incorporate into their operations.
6. Impact Evaluation - Although the public response to the Guide has been very favorable, the Guide's ultimate value will be determined by its capacity to stimulate change in primary dissemination. The project staff has begun to contact a select group of Guide recipients to try to determine whether, in fact, the Guide is actually used to introduce innovations.

All of the above activities will be carried on for as long as the project continues.

#### EXPANDING THE SCOPE OF INNOVATION COVERAGE

The publication and maintenance of the Guide has provided at least one mechanism for stimulating innovation in the primary dissemination of scientific and technical information. With this milestone reached, and based on the encouraging results of the project to date, we have begun to consider similar efforts dealing with other aspects of the communication of scientific and technical information. After all, primary dissemination is only one facet of the communication process, albeit a very important one.

The possible expansion of the innovation-stimulation program poses three questions:

1. How can other areas of scientific communication be defined to best coincide with the interests and needs of prospective innovators?
2. What dissemination techniques should be employed to stimulate the use of new methods by potential innovators?
3. What area, or areas, of scientific communication should the project consider next?

We approached the question of how to subdivide the spectrum of scientific communication functions by developing a functional model that categorized all scientific communication functions, organizations, and professional job categories. Emphasis was also placed on the subdivision of subject areas to provide a grouping of innovation possibilities applicable to coherent audiences of prospective users.

On the basis of this model, we have developed a structure for segmenting the expansion of the innovation project to other areas of scientific communication. This structure consists of the following five basic elements of innovation in scientific communication:

1. Information generation
2. Primary processing
3. Information reprocessing and retrieval
4. Information delivery
5. Information use.

The primary purpose of this structure, as depicted in Exhibit 4, is to serve as a framework for organizing and packaging descriptions of various innovations and improvements for dissemination to those who can apply them.

Although the looseleaf format has been an effective vehicle for presenting information on primary dissemination, it might not be the only mechanism desirable for other areas of innovation. For example, in the case of information reprocessing, the potential audience for innovations consists of several different groups, some of which represent comparatively small numbers of organizations, often with overlapping functional components. These would typically include bibliographic-processing organizations, major information-clearinghouse operations, monographic and state-of-the-art review publishers, and documentation centers. To publicize possible innovations to these sectors, we believe that a combination of a looseleaf book and a series of individual technical memoranda, each devoted to a particular innovation, would probably be the most cost-effective approach.

As the next phase of project activity, we are recommending that innovations in information reprocessing and retrieval be addressed. This recommendation is based on three considerations. First, the rapid growth of scientific and technical literature has made this component of scientific communication increasingly important. Second, this field has become--partly through necessity, partly because of technological developments--a very fertile area for the development and application of significant innovations. Third,

## EXHIBIT 4

### MODEL OF INNOVATION IN SCIENTIFIC COMMUNICATION

FUNCTION	ACTIVITIES	ORGANIZATIONS/ INDIVIDUALS
INFORMATION GENERATION	PROPOSALS RESEARCH PREPRINTS	UNIVERSITIES RESEARCHERS
PRIMARY PROCESSING	TECHNICAL REPORTS JOURNAL ARTICLES REPRINTS MONOGRAPHS CONVENTION ADDRESSES	PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SOCIETIES MEMBERS AUTHORS
REPROCESSING AND RETRIEVAL	PROCEEDINGS ABSTRACTS INDEXES REVIEWS	SOCIETIES LIBRARIES ABSTRACTING SERVICES
INFORMATION DELIVERY	DIRECT MAIL BULK MAIL SELECTIVE DISSEMINATION OF INFORMATION	CLEARINGHOUSE
INFORMATION USE	RESEARCH PROGRAM DEVELOPMENT	UNIVERSITIES RESEARCHERS PRIVATE FORMS GOVERNMENT AGENCIES

there seems to be a definite trend toward some kind of integration between primary information processing and information reprocessing; this makes it difficult to consider one of these areas without treating the other as well.

In considering the needs of information acquirers and users (primarily scientists and engineers) and the libraries that act as their direct agents, yet another approach seems to be indicated. Although many innovations that deal with information acquisition and use would apply to this entire audience, the audience is so large and dynamic (because it is composed of individuals instead of organizations) that direct individual communication from the project is a practical impossibility. As a matter of practical necessity, an alternative method of indirect dissemination must be employed. One way to reach this group of potential innovators is through the various societies of the scientific, technical, and information professions which, together, do reach the vast majority of people who acquire and use scientific and technical information.

A combination of two techniques for indirect dissemination of new innovation ideas has thus evolved. The first technique involves preparing brief technical memoranda describing various innovations; these could be disseminated to the appropriate professional societies for publication in their bulletins, journals, or newsletters. In addition, a series of monographs, giving more comprehensive coverage to the possibilities for particular types of innovation, could be published and their availability announced through the various scientific and technical societies.

#### OPPORTUNITIES FOR PARTICIPATION

The innovation project offers opportunities for participation in several ways. First, we welcome information about innovative approaches to scientific communication. Likewise, we welcome suggestions concerning ways in which innovative approaches can best be communicated.

On an international level, we are interested in placing subscriptions to the primary dissemination Guide with at least one key organization in every country with an active scientific and technical community. The number and pattern of non-U.S. distribution to date is shown in Exhibit 5.

An opportunity also exists for direct cooperation between this program and counterpart programs in other countries. If an organization is willing to undertake an active search for innovative approaches in its country, and to forward such information to our project, it will, in turn, be provided with full access to all project materials and encouraged to serve as the disseminating agency for innovation information in their own country. One arrangement of this type is currently under active development.

#### THE FUTURE FOR INNOVATION STIMULATION

The opportunity to innovate in scientific communication will, we believe, increase at an accelerating rate in the years to come. However, the means by which this innovation is fostered has yet to find its permanent form. The answers to two questions should form the basis for a programmatic solution. The first question is this: what is the impact value of projects such as ours in stimulating beneficial change in scientific and technical communication? Over a period of time, information can be obtained that will help to define and improve the innovation process, as well as assign some value to its social worth.

The second question concerns the establishment of viable long-term mechanisms for innovation concerning information transfer. Up to this point, this project has been sustained solely by financial support from the National Science Foundation. If an active innovation-stimulation program is to operate indefinitely, a broader, more permanent funding basis must be arranged. Funding from several supporting organizations represents one possibility; selling the products and services of the innovation-stimulation program is another alternative.

Experience to date suggests that the next step in this program to stimulate innovation in scientific communication might consist of a three-year effort designed to accomplish the following objectives:

1. Develop an effective program for comprehensively collecting and disseminating innovation information covering all aspects of scientific and technical communication;
2. Collect and evaluate empirical information to determine the potential impact and value of innovation stimulation on the scientific communication process;
3. Develop arrangements for the continuing viability of the program.

If successfully executed, this next phase should bring this developmental program to a point where it can result in a permanent mechanism promoting beneficial change in the transfer and use of scientific and technical information.

**EXHIBIT 5****NON-U.S. GUIDE DISTRIBUTION****DISTRIBUTION SOURCE****RECIPIENT COUNTRY****CSG****AUSTRALIA 2****AUSTRIA 1****CANADA 19****COLOMBIA 1****FRANCE 1****HUNGARY 1****ISRAEL 1****JAPAN 1****LUXEMBOURG 1****MEXICO 2****NETHERLANDS 5****PHILIPPINES 1****SOUTH AFRICA 1****SWEDEN 1****SWITZERLAND 1****UNITED KINGDOM 25****VENEZUELA 1****WEST GERMANY 1**

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## PROSPECTS FOR FACSIMILE IN INFORMATION TRANSFER

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## SUMMARY

Facsimile was originally used primarily to transmit graphical images but the recent growth of information generation and dissemination has increased its potential. Facsimile is now playing an increasingly important role in information transfer generally because of its accuracy, convenience and low labour requirements. Although the majority of machines in operation are 3 - 6 minute analogue devices, machines capable of processing the information digitally in such a way that it can be transmitted in one minute or less are now on the market and the general introduction of such machines at an economic price will greatly increase the use of facsimile.

In the United States computer switched facsimile networks using store-and-forward techniques are becoming available, which will eventually allow a mix of packet switched data and facsimile. In addition to providing a general point-to-point facsimile service, such a network would have the capability to translate facsimile transmissions between networks of incompatible machines. Further developments in the store-and-forward field will allow the recording of facsimile information in buffer stores, with later transmission to automatically called receivers using cheap night communication rates.

This paper reviews these developments and considers the prospects for facsimile in information transfer systems.

## 1. INTRODUCTION

Although facsimile has been commercially available for over 80 years, it has mainly been used for highly specialized applications such as the transmission of weather maps and newspaper photographs. Recently it has been applied to other fields, especially where obvious benefits, not necessarily related to cost, accrue. Examples are: use by the fire services, where diagrams and maps form the major part of the information to be communicated, and by the Job Centres where the received copies may be used directly for display. Another obvious application is for mobile communications in police forces. In addition to the advantages of being able to communicate accurate information relating to the position of premises, photographs of wanted persons etc, the information is more secure from interception by criminals. The use of facsimile is also convenient in single-manned vehicles and instructions can be sent to temporarily unmanned vehicles.

The vast majority of written communications are still sent by post and other messages are usually communicated by telephone. The telephone has the advantage of speed, convenience and two-way communication but it is not suitable for conveying graphical information or tables of figures and there is usually no record of a telephone conversation. Posted letters have had the advantage, at least until recently, of being cheaper than telephone calls but delivery is relatively slow and the service is deteriorating. A letter is permanent in nature and can be retained as a record, but although it may be cheap to send, it can be very expensive to prepare if such costs as typist's time, executive's time for checking, etc, are included. The Telex service, a dial-up teletypewriter communication network operated by the Post Office over a public switched network, is used by business concerns of all types. Charges are based on a fixed quarterly rental plus per call charges dependent on the length and distance of the call. This is similar to telephone charging but there is no cheap rate. Telex is quite economical for sending short messages but where large volumes of traffic must be handled between fixed points, e.g. in an inter-plant operation, it may be more convenient to use private leased circuits. In such cases torn-tape or computer message switching systems may be used, especially where the major use is for routine repetitive communications such as sales or production orders. Data communication over the telephone network has increased considerably in recent years. Again dial-up or leased lines may be used depending on grade of service required and volume of traffic.

It is against the background of these telecommunication services that business facsimile systems must be considered. Initially compatibility between transmitter and receiver presented few problems as facsimile systems were only installed by specialist users. More recently large organisations and Government departments have installed facsimile machines for interchange of messages as well as graphics, in most cases using leased lines. Facsimile is now increasingly being used for general business communications. It may be used for the transmission of information within one establishment, or between establishments belonging to the same firm, and in such cases leased lines may be used. On the other hand, individual users may want to communicate over the public switched network with unrelated users on an inter-company basis. The question of compatibility is of vital importance in such cases and some users have found it necessary to use equipment which will operate on several different transmission standards in order to communicate with the maximum number of other users.

A lot of progress is still necessary in the field of compatibility between machines produced by different manufacturers. At present different machines are unlikely to be able to communicate directly, even if using the same modulation techniques, because until recently manufacturers seem to have ensured that their machines can only communicate with each other. Most major manufacturers are now represented on national and international committees on standardisation and are beginning to co-operate in removing this major obstacle to the widespread use of facsimile communication.

## 2. RECENT DEVELOPMENTS

## 2.1 Scanning

A large number of current machines use the drum method of scanning variously described. An alternative to this method is to move the document slowly over the slit representing a single line and to scan laterally. The lateral scan may be effected by using a rotating mirror optical system, or by a method

popular in Japan (ref.1) using optical fibres to guide the reflected light from the scanned line to the photo-sensitive device. These scanning methods generally allow faster speeds and the use of optical fibres also results in a decrease in the size and complexity of the scanners. Flying-spot scanners perform the scanning entirely electronically by utilizing a raster similar to that used in television scanning. A spot of light from a cathode ray tube is focused on to the document and, as the spot traces out the raster scan, the reflected light is detected as previously described. This technique has particular advantages for flat-bed scanning of books, etc.

## 2.2 Resolution and data compression

Whatever the form of scanning used, the quality of the reproduced image will be determined by the resolution capabilities of the scanning device. Resolution in this context is a measure of the ability of the scanning system to distinguish between adjacent elements of the image. In facsimile and television systems resolution is used to specify the scan density, i.e. the number of scanning lines per linear dimension. The resolution capability of facsimile systems is usually quoted in lines per inch, the standard figure being 96 lines/in. (i.e. approximately 4 lines/mm), whereas in television systems the number of lines constituting the entire raster is quoted, e.g. 625 line domestic television (approximately 2 lines/mm). The resolution of these scanning systems is actually controlled by two sets of variables, relating to the width or height of the reproduced image. Resolution at right angles to the scanning axis is determined by the scan density defined above, whereas resolution along a scan line is determined by the rate at which the system as a whole can react to tonal variations in the image.

There is a difference in the resolution requirements necessary to ensure word recognition as opposed to character recognition. In the first case, individual letters need not be positively identified as long as the word as a whole is legible, whereas in the second case every individual character must be identified. Examples of documents needing different resolution requirements are a conventional message and a technical report containing graphs and equations. In the scanning process the individual characters are dissected and the number of scan lines per character has a direct bearing on legibility (ref. 2). Costigan (ref.3) quotes results of various research workers, which show a requirement of five scan lines per character for word recognition and ten for individual character recognition. Thus word recognition using the standard Elite typewriter typeface would require a resolution of approximately 90 lines/in., whereas character recognition for the six point type often used for subscripts and footnotes in technical journals would require 210 lines/in. Assuming 100 lines/in. scan line density and equal horizontal and vertical resolution, then a standard A4 page approximately 8½ inches by 11 inches in dimension would contain about 900,000 elements and, in the case of transmission of text with only two levels of black and white, this corresponds to 900,000 bits of information. In order to obtain a measure of the transmission time required, assume this facsimile signal is transmitted over the Post Office telephone network at the standard data transmission rate of 2.4k bits/sec. Then the transmission time would be  $900,000 \div 2,400 = 60$  which is approximately six minutes.

The relationship outlined above between resolution, channel bandwidth and transmission time is the controlling factor in normal facsimile operation. Transmission time can be reduced by using wider bandwidth channels or by degrading the resolution, but the former leads to excessive costs and the latter results in the received copy being of poor quality and eventually illegible. So considerable efforts have been made recently by manufacturers to compress the data obtained from the scanning process prior to transmission. Until the last few years the complexity of the electronic circuitry required made such techniques impossible, but the advent of large scale integrated circuitry now makes facsimile data compression feasible and machines are already on the market incorporating compression hardware. The amount of compression theoretically obtainable for a typical typewritten page is considerable. Characters are usually represented in data transmission by an 8 bit code, so a page of 1,000 characters could be transmitted as 8,000 bits of information and on a 2.4kbit/sec channel this would take 3.3 seconds. The facsimile signal for a whole page scan at 100 lines/in. takes about six minutes and there is therefore more than a 100 : 1 difference between the two methods. Until optical character recognition techniques become practical and economic such an impressive compression ratio cannot be achieved in practice, but considerable reductions can be obtained by exploiting the inherent redundancy present in typical documentary information, in the form of blank paper or margins, at the top and bottom of the text, between lines etc. The actual compression ratio attainable is thus dependent upon the material being scanned and this factor must always be taken into account when comparing quoted figures. Data compression can be applied to either analogue or digital signals, but as in the former case it is usually some form of variable velocity scanning, whereas in the latter case it can be electronic logic circuitry the systems so far developed have concentrated on digital facsimile signals resulting from the scanning of black and white text.

There has been a great deal of interest in recent years in the coding of images to reduce bandwidth and at first glance it would seem that many of the techniques proposed should be relevant to the facsimile field. However, closer investigation shows that this is not necessarily so. For instance, many of the compression techniques proposed for video systems rely on parameters such as frame-to-frame correlation and temporal-spatial resolution effects in the human eye and so are not relevant to facsimile where a single image is transmitted and is then available for detailed examination over a long time period. Some of the basic systems which may be used to compress the data in a facsimile image are outlined below:

- (a) Systems in which the image is scanned in a conventional line-by-line manner to produce a continuous stream of data which is then encoded by a suitable algorithm to reduce the number of bits in the stream. The image data stream can be divided into a series of consecutive sections which can be of constant or variable length analogous to block or variable length codes. These code words can then be translated into a further series of less redundant code words which again can either be block or variable length codes. Examples of this technique include run length coding, in which the image data stream is divided into sections consisting of a continuous sequence of black or white picture elements. The length of each successive run is transmitted in the form of a pre-arranged code which enables it to be reconstructed at the receiver. The runs are necessarily variable length but the signalling code may be block or variable length.
- (b) Systems in which the digit stream representing the image is processed before encoding to produce a

less redundant or more suitable bit pattern. Examples of this technique include the differential encoding of the image so that the new image only contains information concerning the changes of brightness in the original image. In the two-level image a transition from white to black or black to white is signalled by a 1 and all other positions are packed with 0.

- (c) Systems in which the image is transformed into another suitable domain and the appropriate coefficients in this domain are encoded to reduce redundancy before transmission. Examples of this technique include taking the Haar, Walsh, Fourier, Slant transform of the image. The transform may be taken in one or two dimensions but the hardware needed is complex if more than a small section of the image is to be operated upon in any one transform. One of the main advantages claimed for this technique is that as the link errors are introduced into the transform plane they are distributed or smeared in the retransformed image.
- (d) Systems in which the inherent excess resolution of the image is exploited by arranging for the resolution of the received image to increase with increasing transmission time. The transmission can then be terminated when sufficient resolution has been achieved

Many studies have been made by research workers of these varied forms of data compression, but the general conclusions which emerge (ref. 4) tend to show that it is possible to achieve a modest compression using relatively straightforward techniques, such as run length encoding, but that more complex techniques only produce a small further improvement. In any general calculations it would be unwise to assume a whole-page compression ratio greater than 5 : 1 although this figure may be exceeded in certain specific cases.

### 2.3 Recording techniques

The received facsimile signal, when demodulated from the carrier medium, produces a permanent record of the original image. The electrolytic method previously described was one of the earliest processes used and is still in use in some machines, but there have been considerable developments in recording methods. Machine cost, paper cost, resolution and transmission time are factors which must be considered. The electrolytic and electrostatic methods are both simple processes, but do not produce such good results as the more complex photographic recording processes available. Electrostatic recording, similar to the process used in some office copiers, is an increasingly popular method as it gives good contrast at higher recording speeds. A high voltage on the stylus causes the build-up of an electrostatic charge on the surface of special non-conducting dielectric paper. A toner, which adheres to the charged pattern, is applied to the paper and a permanent image is fixed by heating. Some machines use a single moving stylus, but the use of multi-stylus recording heads made by printed circuit techniques has become popular, particularly in Japan (ref.1). Electrosensitive burn-off techniques produce a good contrast image on special resistive paper. This paper is coated with conducting layers of carbon then covered with a white top layer. Where voltage from the stylus is applied a current passes through the paper and burns off the white surface, leaving a black mark. Although this process provides a good quality copy, it can produce an undesirable odour if the machine is used in confined spaces and the copy is not permanent, being prone to smudging. Laser recording, using either photographic or electrostatic processes, appears to be a promising technique. High resolution and high speeds are possible and some machines have already been developed for special applications. As the price of lasers continues to fall this method may become more popular, but the official attitude to the safety problem may be the controlling factor.

The paper used for electrolytic techniques is the cheapest and that used for burn-off the most expensive. If ordinary plain paper could be used as the recording medium there would be considerable advantages. Various means of writing directly on to ordinary paper under control of the received signal have been investigated. In Japan particularly (ref.1), great interest has been shown in ink-jet recording and machines which use this technique are now commercially available. Different colours of ink may be used, but there is no grey scale capability. An easily replaceable ink cassette is used, the jet nozzle is concealed in a cover filled with saturated vapour of ink solvent and it is claimed that the nozzle does not get clogged up even if left unused for several days. During the black level intervals of the signal the jet nozzle is raised to a sufficiently high voltage relative to the recording drum holding the paper, that the resulting electrostatic force causes drops of ink to be drawn from the nozzle and deposited on the paper. Field service has so far been insufficient to determine the maintenance problems.

### 2.4 Automated systems facilities

In order to facilitate the unattended operation of facsimile systems during off-peak telephone charge periods, manufacturers are beginning to offer a variety of attachments to the basic machines. These include automatic stack-feed units for the continuous supply of documents to the transmitter and automatic answering and continuous roll paper supply at the receiver. Automatic polling enables a central receiver to poll unattended send stations and to initiate transmission of a number of documents. The receiver provides a hand-shaking or recognition tone to the transmitter, preventing unauthorised operation of the unit. Switching and broadcast concentrators may be used on private lines to enable one transmitter to send to several receivers simultaneously, or just to selected receivers.

A major development in system design is the incorporation of a microprocessor into the facsimile transceiver, a development which many think has the potential for rapid growth. It opens the door to many sophisticated systems facilities, such as queuing callers in a facsimile network and holding transmissions until cheaper rate communication links become available. It can handle protocols from computer input allowing a facsimile system to be accessed from discs, drums, tapes etc. The microprocessor also gives the ability to selectively call receivers in an electronic mail application. For instance a number of messages can be sent to selected addresses by automatically identifying the called party, placing the call, sending the message, ending the call then calling the next party.

### 2.5 Compatibility

Most major manufacturers are now represented on national and international committees on standardisation and are reaching agreement on compatibility of modulation methods, transmission time and control techniques.

Compatibility is dealt with in three group recommendations and agreement has already been reached on the first two.

Group 1 covers the basic facsimile machine which takes approximately six minutes to transmit an A4 document. This is a fully analogue mode using frequency modulation techniques and can be used for grey scale transmission. Equipment in this group will be fully compatible with several present generation machines.

Group 2 covers machines capable of transmitting an A4 document in 3 minutes. This also is an analogue mode using vestigial sideband amplitude modulation.

A number of machines are already on the market which conform to these recommendations and some are switchable to allow them to operate in either group, thus increasing their flexibility.

Group 3 machines will be fully digital, accepting only two-tone subject copy and performing redundancy reduction of the scanned image prior to transmission at 2,400 bits/sec. Transmission speed will adapt to the information content of the document and will probably vary from about 30 seconds for a very brief letter to just over a minute for a fairly densely typed page. Although formal agreement has not yet been reached on the group specification it is not likely to be very long before the sampling rate and method of coding are agreed so that machines can talk to each other and to interface with computers.

### 3. AVAILABLE COMMUNICATIONS FACILITIES

Facsimile, like other forms of data communication, must rely primarily on the existing telecommunication facilities which have been built up over the years mainly for vocal communication. Communication channels suitable for facsimile transmission available in the U.K. at the present time include the following:

- (a) Dial-up voice-grade lines on the switched telephone network. These lines have very variable transmission characteristics; trunk circuits normally meet internationally agreed bandwidth requirements of 300-3,400 Hz, but some local lines may only effectively pass frequency components up to about 2,700 Hz. Impulsive noise caused by the electromagnetic switches in the network, and delay distortion caused by the fact that not all frequency components are transmitted at the same speed, can affect the reception quality of facsimile images.
- (b) Leased voice-grade private circuits permanently wired between specific points. These circuits are offered under various tariffs and provide different performance characteristics at different costs. They are in general less prone to impulsive noise and, since the connection is permanent, steps can be taken to correct the effects of delay distortion.
- (c) Leased wideband circuits permanently wired between specific points. These circuits have a bandwidth of 48 kHz and in special cases it is possible to rent 240 kHz circuits. In this country such wideband circuits have usually only been used for high quality newspaper facsimile and the rental costs are likely to preclude further extension of their use.

Reference has already been made to computer switched digital networks in the United States and the Post Office is actively investigating digital data services from two angles. Firstly there is the conventional point-to-point circuit switched for the temporary use of two subscribers. It is anticipated that eventually speech and data will be combined in such a digital network but it is likely that they will be treated separately for a number of years. As an alternative, the packet switching of data is under investigation and an experimental system has been in operation since 1975 to evaluate this mode of operation and the demand by potential users. The principle of packet switching involves feeding a packet of data with an agreed format, including identifier, address, maximum message length, etc, into a computer controlled network and allowing the network to dynamically route the packet to its destination. Its initial application is in data transmission, but in principle digitised facsimile signals can be treated in exactly the same manner, the main difference being that the number of data bits in an uncompressed facsimile image, perhaps 10 million bits, puts a much larger burden on the memory and transmission capacity of the switching computers. The number of facsimile messages which could be handled simultaneously would be small, with a resultant adverse effect on the average cost per message. As data compression techniques come into widespread use and computer memory costs continue to fall, the economics of computer switching of facsimile signals will improve and packet switching may be viable. However, this is for the future and for the time being facsimile transmission will have to rely on public switched or private leased voice-grade circuits.

### 4. SOME CURRENT APPLICATIONS

#### 4.1 Department of Employment

The current trend in the Department of Employment is to decentralize operations from the old style Employment Exchanges to Job Centres located in major towns and cities. These Job Centres are more like the commercial staff agencies. In large cities such as London, Birmingham, Glasgow, etc, there may be as many as 16 Job Centres. Job hunters living near one Job Centre may be willing to travel to the other side of town if the right employment is available, but the company offering that employment will probably only notify the local Job Centre. It is therefore necessary for all vacancies in one city to be notified to all the Job Centres in that city and the Department of Employment has decided that the best way to achieve this is by a facsimile network. Details of vacancies notified to each Job Centre are broadcast simultaneously to all other Centres on a radial network from a central concentrator. It operates practically continuously eight hours a day over tariff T leased lines. This system is at present in operation in several major cities in the U.K. using the standard Muirhead equipment with electrostatic recording. It is hoped that the copy from these machines will be of a sufficiently high quality to be used for display in Job Centre windows. Muirhead have specially developed a new automatic facsimile switching unit for use in the Job Centre network to replace the manual concentrator. This unit provides the necessary interfacing and control circuitry for routing a minimum of seven simultaneous calls, expandable in groups of seven, utilizing a programmable microprocessor responding to remote control signalling. The system will cope with a maximum of 128 transmitters and receivers in any combination. Transmission traffic pattern selection and control is effected by touch-tone keyboards located at each facsimile transmitter. Receivers may be individually selected and called or automatically assembled for a pre-programmed conference. A

facility is also included for queuing calls when receivers are busy.

#### 4.2 The Fire Services

A vast store of valuable information, in the form of records, inspection reports and plans of many thousands of buildings, properties and business concerns is held at various levels in the Fire Services. The provision of information of this type at the scene of a fire would be a tremendous asset to the officer-in-charge providing him with instant local knowledge, a prewarning of any hazardous building features, the location of any dangerous substances within the premises, etc. By utilizing the mobile communication links this information in printed form can be directed to the fire-fighting force at the scene of the fire. Several Fire Services have therefore installed computerized information systems giving on-line access to central updated records. On receipt of a fire call the appropriate location is input to the system at headquarters control and details of the property are automatically transmitted to the mobile printer terminals on the fire appliances. This printed information can be augmented when necessary by facsimile transmission to mobile receivers of plan drawings of buildings, large factory area layouts, hospital access routes and map sectors with references. Speech and facsimile signals are received by a normal mobile radio receiver, facsimile signals being extracted from the detector and fed to the mobile facsimile recorder.

#### 4.3 The Post Office facsimile service

The Post Office has in the past regarded facsimile as a peripheral service, but are now finding that there are more machines than forecast using both their public switched and leased lines. The three-six-minute machine is seen as the main machine and point-to-point circuits are envisaged as the main means of communication, rather than packet switched networks. Facsimile is not expected to kill the Telex service, but if it really expands it could affect its growth rate.

As there has been a considerable increase in interest in facsimile services the Post Office recently embarked on an experimental service known as Postfax. Ten cities were linked in a new postal service which enabled copies of documents to be transmitted over the telephone network. This service, which started on October 28, 1974, is the first public service of its kind in Britain and it is claimed that copies of documents handed in at selected post offices will normally be in the hands of the recipients within three hours. Postfax transmits documents to the post office in the city of destination where they can either be collected by the recipient, who will be telephoned when the item is ready for collection, or delivered by Post Office messenger for an additional fee. The service is based on the Plessey KD111 Remote Copier and text, maps diagrams and drawings up to a maximum paper size of 14 in. by 8½ in. can be handled. The Postfax Service was initially run on an experimental basis for twelve months and during that time assessment was made for the market potential and costs of a permanent and possibly enlarged operation. Postfax operated initially between principal city centre offices in Bristol, Belfast, Birmingham, Cardiff, Edinburgh, Glasgow, Leeds, Liverpool, Manchester and two offices in London. The cost was £2.50 for the first page and £1.50 for each extra page (plus V.A.T.). Delivery was 60p (plus V.A.T.) extra, available to specified postal districts within the area of the receiving post office. Same day service was available from Monday to Friday during normal business hours. The scope of the system has now been widened to cover 22 major centres throughout Britain. The system has been modified to operate on the CCITT Group 1 internationally recommended standard and business organisations with their own facsimile systems can contract with the Post Office to link their own compatible machines to the whole of the Postfax network.

#### 4.4 High speed services

The facsimile communication services described above all use the conventional three-six-minute machines and there are a considerable number of similar applications in other government, commercial and industrial establishments. There is one high speed machine currently available for voice-grade channels and its use so far has been restricted by its cost and initially also by the problems associated with its connection to the Post Office public switched network.

Banks are evaluating the use of this machine using international leased lines between London and New York. They need to exchange documents and financial information associated with international loan agreements, which can amount to hundreds of millions of pounds a day, hence speed and accuracy are of the utmost importance. The leased line costs more than £50,000 a year in rental and time zone differences mean that there is a restricted time available for communication, therefore the cost of the facsimile equipment is insignificant, bearing in mind its speed advantage. The main problems so far have been due to line faults and the necessity for delay equalization. In some cases the input cables to the facsimile equipment have to be screened because of equipment susceptibility to local noise. However this is an application where factual accuracy is of the utmost importance and the experiment is intended to evaluate the benefits of facsimile in this context.

### 5. PROSPECTS FOR FACSIMILE IN GENERAL COMMUNICATIONS

When considering facsimile as a competitor with the postal services and Telex, it is necessary to distinguish between internal and external communications requirements. Internally the use of facsimile presents some intriguing possibilities, particularly for the speedy transmission of memos etc, between offices. A cheap and simple facsimile unit on executives' desks with internal lines not dependent on normal voice-grade channels could replace the office photocopying machine and the internal post. An original memorandum could be entered into a machine and by the use of suitable dialling codes could produce copies simultaneously in a number of recipients' offices. Looking further ahead to the paperless filing cabinet, we can visualise automatic storage and retrieval of both textual and graphical information in microform with micro-facsimile links to remote display or hard copy terminals (ref.2).

In the immediate future, however, facsimile systems are more likely to be competing in the external communications field. Here the criteria for comparison are:

- (a) Transmission time

- (b) Confirmation of receipt of message.
- (c) Language used.
- (d) Accuracy of information transfer.
- (e) Ease of operation.
- (f) Cost of the service.

When considering transmission time the important factor is how quickly information is needed. If 24 hours or more is acceptable, then the speed of delivery provided by the postal service may still be adequate, but much shorter transmission times are often needed. For instance, an executive at a meeting at head office may require statistical or sales information from a branch office. Brief details may be obtained by telephone but more comprehensive information would be better sent by Telex or facsimile. Confirmation of receipt of a message is not normally obtained when using the post unless special rates are used, but both Telex and facsimile normally do this, though in certain cases it is possible to transmit to an unresponsive receiver.

Information can be transmitted in two ways, either by the use of discrete alphanumeric symbols or in diagrammatic form, including the ideograms and hieroglyphics used in some languages. Both letter post and facsimile can handle either form, but the Telex system is normally restricted to alphanumerics. The major advantage of the use of alphanumerics is that it permits the use of lower bit rate transmission systems with consequent lower transmission costs. The disadvantages are the significant restraints on the format of the information transmitted. Facsimile, in removing the restriction on information format, introduces considerable redundancy in its standard form and hence higher transmission times and costs.

Thus, when transmitting the information contained in a hard copy original, the original can either be placed in an envelope for postal transmission, converted to an electrical signal by character keying for Telex or scanned for facsimile transmission. The accuracy of information transfer is affected by the errors introduced in the communication process. These errors may be caused by interference and noise on the electrical signals or they may be human errors, for instance in the typing or transcribing of the message. Facsimile has the advantage over Telex here, since it is possible to transmit original handwritten messages without further transcription. Also, the scanning process introduces a degree of redundancy which acts in an error correcting mode, the degree of correction depending on the amount of data compression incorporated, since this compression increases the vulnerability of the data to errors. A facsimile system is generally much easier to use than a Telex system, as general clerks are usually capable of setting up a facsimile call and inserting copy into the transmitter. It is possible to use a Telex machine on a casual basis, but, it is usually necessary to employ a specially trained, and hence more expensive, Telex operator to ensure efficient communication. Thus there are several important criteria on which to base a choice but it is really only in respect of costs that the postal service can compete with either Telex or facsimile.

Charges for postal services depend on the weight of the item and the desired speed of transmission and there is no direct relationship between either of these factors and the information content of a letter. The actual weight is often determined by other factors than the number of words it contains. In Telex transmission over the public switched network the cost is closely related to distance and the time for which the circuit is connected and this latter factor is linked to the information content of the message. On the other hand, while facsimile operates on the same two criteria, where no redundancy reduction is employed the circuit time is related to the area of paper scanned, regardless of the word content and it is only with the incorporation of the data compression equipment that the actual amount of information transmitted determines the cost. However, if leased lines or midnight line connections on the public switched telephone network are used, then different criteria are important in determining costs.

When considering costs the original formatting of the message is important especially in the case of facsimile. Letters and memoranda are usually produced to a stereotyped format and the actual information content is often a small proportion of, say, an A4 page. Standard desk top business machines have stops fitted to allow a proportion of the page to be scanned and, if the information content is properly formatted, a considerable saving in transmission time and hence cost can be achieved without resorting to the expense of redundancy reduction. Facsimile charges are related to the time required to scan the document and for an A4 page this time may be three, four or six minutes with standard machines. Redundancy reduction techniques can bring the time down to one minute or less depending on the amount of information on the page. If a Faxgram format is used, then, assuming standard typescript can be accommodated at ten words per line and six lines per inch, each of the standard machine times can be reduced as in Table 1:

Machine type	100	300	500
6 minute	0.86	2.58	4.31
4 minute	0.57	1.71	2.87
3 minute	0.43	1.29	2.15

Table 1 Actual time for scanning words (minutes)

An alternative means of transmitting facsimile over the dial-up network is by making use of the midnight line facility. This service is not based on distance and per call time, but a user is allowed unlimited dialled calls within the U.K. between the hours of midnight and 6.00 am for a charge of £238 a year. Thus the greater the volume of information transmitted within this period, the lower will be the per-page cost. Table 2 shows the transmission costs for this service using machines of different speeds. It is assumed that the line is used for 230 nights a year and automatic dialling takes 30 seconds in addition to phasing and acknowledgement.

Time per page (min.)	Max. pages per night	Cost in pence per page
6	52	2.0
4	74	1.4
3	93	1.1
1	227	0.5

Table 2 Transmission costs using facsimile over the midnight line service

## 5.1 Overall costs - mail application

Transmission costs are not the only costs incurred in the process of information transfer. Generation may take the form of dictation, shorthand and typing, or original manuscript draft sent direct or transcribed by a typist or Telex operator. Alternatively the information may take the form of tables of figures or diagrams. In order to obtain a measure of the relative overall costs of information transfer, two cases will be considered. The first is the transmission of a message which will be assumed to originate in manuscript form. This message can be posted either in its original form or it can first be typed. Alternatively it can be transmitted by Telex or facsimile from the original or from a typed transcript. Assume that both the original manuscript and the typescript contain ten words a line and six lines per inch of A4 paper. The effective cost of employing a typist or Telex operator is currently about £3,000 a year. Hence assuming a 230 day, six hour a day working year and the use of an electric typewriter, the cost of typing at an assumed speed of 40 words a minute will run at approximately 11 words for 1p. In order to keep transmission costs down, Telex users often prepare punched paper tapes off-line for subsequent automatic transmission at higher speeds than would be possible on direct transmission. Assuming the same operator deals with both tape preparation and tape transmission then the overall average keying speed will be lower than that of a typist as for every 66½ words per minute transmitted, the tape preparation time at 40 words a minute typing rate must be added. So allowing for Telex machine rental costs the average output cost is about six words for 1p. This costing assumes that the Telex machine is receiving while the operator is keying off-line but there could be queuing problems which would reduce the effective output.

Facsimile machines can be rented or purchased and the cost depends upon the machine used. Most users rent facsimile machines because of the present fluid state of development. Although it would probably be cheaper to buy a machine and write it off over five years, rental costs have been used in the calculations that follow. It is also assumed that an operator is in attendance while the copy is in the machine, and although a lower grade operator than is necessary for Telex work or typing could be employed, the same total cost of £3,000 a year is used. In practice there would be an additional saving because the operator would probably find other things to do while the machine is transmitting. Some illustrative graphs of relative costs are shown in Figures 1 and 2. It is clear from the graphs that in general the postal service is still the cheapest method of information transfer, but if use is made of the Faxgram technique then facsimile is cheaper than Telex and may undercut postal costs. This is even more relevant if manuscript originals are used for facsimile and Telex. If the system were sufficiently automated to make full use of the midnight line facility, then the use of facsimile as an electronic mail service would be very attractive.

## 5.2 Overall costs - inter-works application

The second case is a comparison of various ways of sending inter-works messages. The labour costs are those quoted by a large manufacturing company in the London area. The costs are based on a 240 day year and it is assumed an average typist can deal with 80 standard letters a day, a standard letter containing 230 words. It is also assumed that the letter can be compressed to 130 words for Telex transmission and the Telex operator can handle 40 such transmissions in a day. The cost of a typist is taken as £2,500 a year and the cost of a Telex operator is assumed to be £3,500 a year, both figures including overheads. The current policy of the company is to rent facsimile machines during the present fluid development period and it is assumed that Telex and facsimile rental costs are the same. A Telex message switching unit is already in operation in the head office, so only a single labour involvement is included whether Telex messages are single or multi-addressed. Costs of dictation by middle range management personnel are included in the figures shown in Table 3 and it is assumed that typed copy is used in facsimile transmission, but that original manuscript copy is used by the Telex operator.

Letter		Telephone	
Dictation	- 66.2	Call placement	- 1.9
Shorthand/typing	- 46.7	Conversation time	- 39.5
Stationery	- 5.2	Recording of message	- 39.5
	118.1 per message		80.9 per message
	139.0 for 5 addressees		404.5 for 5 addressees
Telex		Facsimile	
Origination	66.2	Dictation	66.2
Keying and routing	83.8	Shorthand/typing	46.7
	150.0 per message	Paper/forms	5.7
	150.0 for 5 addressees	Attendance	14.3
			132.9 per message
			190.1 for 5 addressees

Table 3 Labour costs associated with inter-works communication, in pence

These costs plus the transmission costs previously referred to provide an overall comparison of the various communication methods, bearing in mind that machine costs have been excluded. Whereas in the previous example, facsimile had a clear advantage over Telex for all but very short messages, in this case the

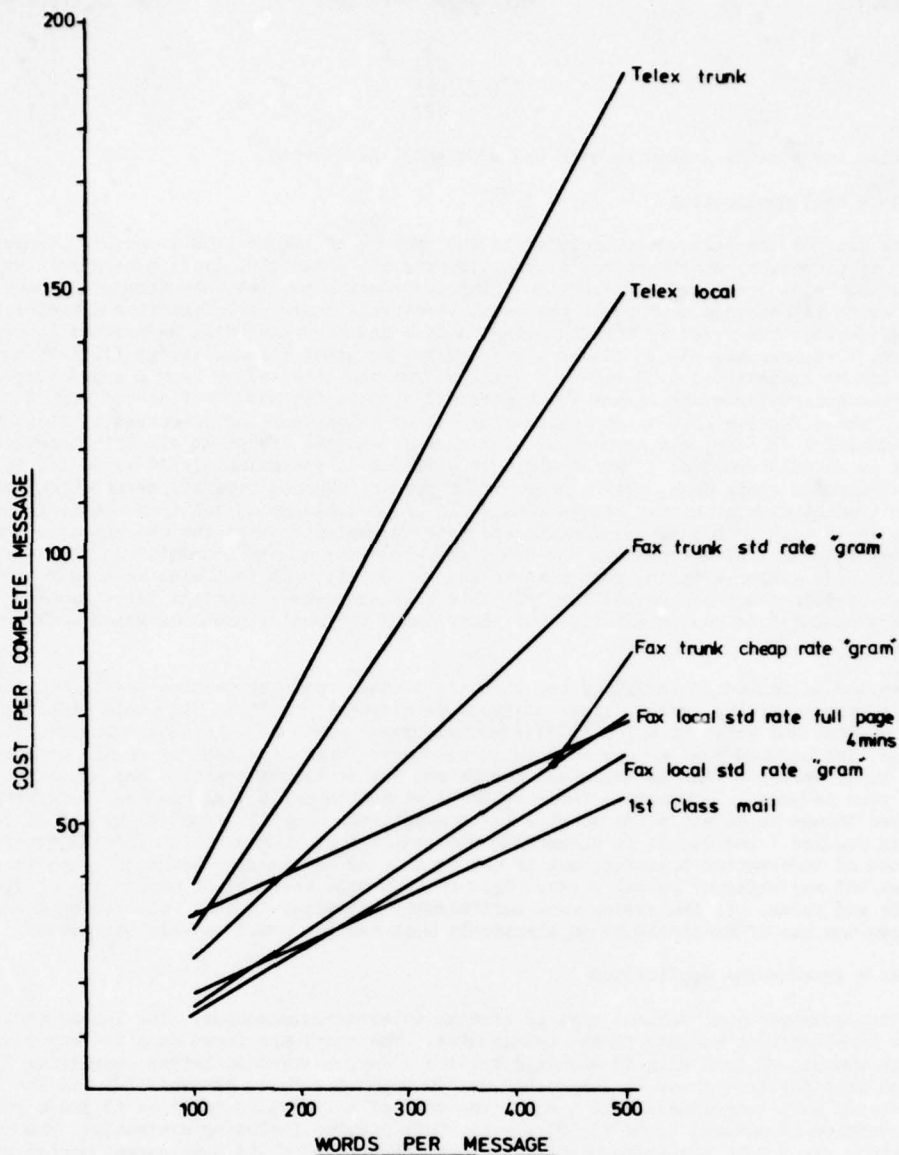


Figure 1 Overall message transfer costs ( including typed originals)

company is already geared up for efficient Telex transmission and assumes that facsimile will use full page typed copy as the input medium. It is therefore clear that it is not enough to install facsimile machines and assume everything else can continue as before.

### 5.3 Comparison with word processing systems

Recently introduced office products by some of the larger manufacturers have merged the disciplines of data processing, word processing and communications. Thus extremely powerful office systems have been erected by grafting a floppy disc controller onto a high speed printer which can be programmed to produce any number of different type styles with multiple print outs. The basic printer can be equipped with paper and envelope feeds and can be programmed to perform a wide variety of time consuming and repetitive office jobs in a stand alone configuration. It can print reports and standard letters and sort facts and statistics into printed documents simply and quickly. It can amend, update, sort and re-arrange information and, linked to a suitably programmed central computer, it can access files and information or serve as an output device where high quality printing is required.

When fitted with a communications facility, such as a data modem, prepared text and information can be distributed rapidly where needed over leased and switched public network lines. One office system can thus communicate with another in the same building or at more remote points to exchange information or to print in local offices a text prepared centrally. The basic components from which a system can be built comprise a typewriter keyboard, a visual display, a magnetic card unit, a high speed printer and a unit to read and write to disc.

Such systems are bound to play a significant part in electronic mail applications in the future but they are likely to be expensive when compared to facsimile and of course they can only handle text.

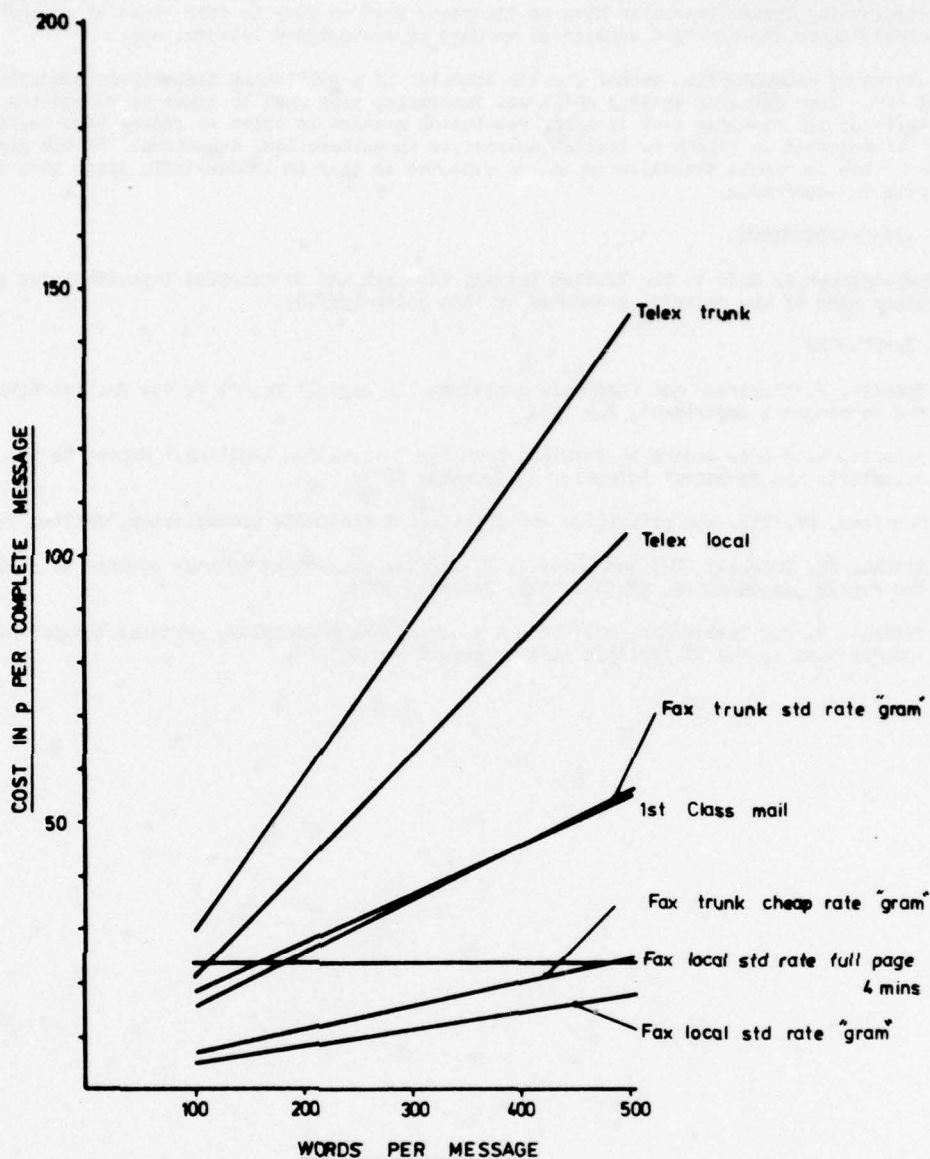


Figure 2 Overall message transfer costs (manuscript originals for Telex and facsimile)

#### 6. CONCLUDING REMARKS

The main benefits of facsimile transmission, i.e. accuracy of copy and low labour requirements, are beginning to accelerate the long awaited upsurge in the market, particularly in the London area. This is particularly noticeable in Government departments, where decentralization is becoming essential due to high building and rental costs, high salaries and staff difficulties. The facsimile machine is proving a valuable adjunct in the operation of information networks and this increase in use has occurred without the introduction of radically new equipment or new Post Office communication facilities. However, the improved reliability and quality of the basic facsimile machine, with added systems facilities such as unattended reception, broadcast capability, etc, have doubtless been influential. The sub-one-minute machine is already with us, albeit at a price, and when data compression equipment comes into widespread use and the Post Office data network becomes fully operational, the situation will be improved.

For the transfer of information in bulk the postal system still has a lot to offer and in local areas vehicle distribution services are very useful. Costs are increasing all round, including telephone line time costs which directly affect facsimile transmission. However the postal system is already beginning to suffer due to the labour intensive nature of its operation and vehicle delivery services are being badly hit by soaring fuel costs and chaotic traffic conditions. The Telex service is well established and is providing a very useful service, especially where short messages are involved. In many situations where message switching systems are incorporated for multi-address transmission, Telex is cheaper than facsimile. However good Telex operators are not easy to find and transcription errors cause problems. For longer messages facsimile transmission has the advantage, especially if the Faxgram format is used. If business letters are assumed to be typed, and in introducing a new service one could postulate the use of manuscript originals, then facsimile costs can begin to approach standard postal costs if there is a sufficiently high density of traffic. If a store-and-forward facsimile system using Post Office night rates or midnight line facilities were used the cost comparisons would be even more favourable. However, it must be noted that

word-processing typewriters also have an important part to play in this class of message transmission, especially where the messages consist of volumes of stereotyped letters, etc.

The choice of communication method for the transfer of a particular piece of information is not always clear cut. When devising systems which use facsimile, care must be taken to choose the right equipment, eg, it is no use choosing a 67 line/in. resolution machine in order to reduce time costs if the material to be transmitted is likely to include subscripts in mathematical equations. If the right machines are chosen, then facsimile transmission can be expected to play an increasingly large part in information networks in the future.

#### 7. ACKNOWLEDGEMENTS

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## THE LIBRARY IN THE FUTURE

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## ABSTRACT

There will be significant changes in the way people gain access to information in the future. Current access patterns will be influenced greatly by new technological developments and by new perceptions of the information requirements of users. Libraries will assume new roles and perform new functions if they are to become more than archives of recorded knowledge. The library of the future will be an active communication device or it will wither and be essentially a warehouse operation. There will be a need for better management control of library operations through system analysis and feedback techniques. Library cooperative efforts using networking arrangements will proceed slowly in specific areas of library operations. These and other matters concerning future library systems and services are discussed.

INTRODUCTION

It has become rather common practice to observe changing events and conditions in segments of our environment and then attempt to forecast their significance for the future. Economists, financial analysts, military strategists and other planners speculate on the future regularly and forecasting has become a profession for many. Those involved in information and library activities also attempt to interpret the significance of new developments for future operations. It is particularly important today that they do so since there are new imperatives for libraries and information centers that will alter long-established conventions and practices for providing information services. They stem from a broad spectrum of technological, economic and social changes occurring in most countries of the world, including the NATO nations, and their impact will be evident in many facets of the library and information business as we know it today. More specifically, we are experiencing the evolution of new techniques and systems for generating, acquiring, organizing, storing, retrieving and disseminating information. New formats of information display are apparent and increasing constraints on information reproduction and distribution are in evidence. The economic aspects of information service will demand greater management skills than in the past since costs will in many cases be covered by service charges, and these will need to meet the test of the marketplace. Along with these changes we shall find a type of information specialist emerging who will offer new insights on the design and operation of information systems. These changes will take time but the signs are clear and unmistakable; the evolution is already underway.

It is an interesting fact that the precepts and patterns for library work established 400 years ago by Melvil Dewey and a few others are still very much in evidence today in literally thousands of libraries throughout the world. The Dewey Decimal System and its lineal descendent, the Universal Decimal Classification, are still the world's most widely used library systems for classifying information. In addition, the types of jobs performed in libraries continue in large degree as they existed then; catalogers, indexers, reference librarians, loan clerks, etc. Only in large libraries or highly specialized information centers will one find much deviation from the 1876 norm. In comparison with the telephone which also evolved 100 years ago, today's library systems are far behind our modern telecommunications systems. The growth of new and improved telecommunication systems for storing, transmitting, switching and delivering information has demonstrated what can be accomplished in the information business and much of this experience is relevant to the library in the future. In fact, much of it already has been applied in the Bell Laboratories Library Network(1). The analogy between the library and telephone business is a good one since comparisons are reasonable. They share the same objectives, face similar problems and require many of the same type of solutions for effective information transfer. There are of course notable differences in the way the library community and the telecommunications community have gone about their respective businesses. This divergence is most noticeable in the economic principles applied, the use of technology and the development of systems engineering techniques for achieving improvements; all of which are highly developed in telecommunications but hardly developed at all in library work. Similarly, the idea of networks (of libraries) so popular these days has been for years a hallmark in the telecommunications field. The application of these valuable developments of telecommunications would appear essential to the survival of libraries in the future. The following paragraphs provide some of the reasoning in support of this.

## ECONOMIC IMPERATIVES

In general, when we speak of economics we refer to matters concerning the production, distribution and consumption of goods or services. The principles of economic activity dealing with plant investment, operating costs, marketing, planning, etc., are widely applied in many business and industrial endeavors, including telecommunications. Supply and demand, inventory control, management and fiscal viability are major determinants of economic success. The test of economic success frequently is determined in the marketplace. Although common to successful operation of many enterprises, these economic principles have been applied rarely to the library business. As long as libraries could be equated with "motherhood," "love of country," "human dignity" and other unquestioned virtues, there was perhaps less pressure to apply economic measures to insure effectiveness in the library business. It was even considered laudable for many university libraries to vie with one another in multi-million volume collection building games. It mattered little that 80% of the volumes were almost never used. In many universities these games are still in play but there is a rapidly growing disenchantment with the high cost of admission. It is apparent that the rules of the game must change if libraries are to survive and changes are indeed taking place. The blueprint for the future is clearly distinguishable as an economic blueprint rather than one born of "motherhood."

An early manifestation of the new concern for economic viability was the establishment of the National Lending Library in the United Kingdom. Existing procedures for interlibrary loan of materials among libraries were not responsive to either time or cost requirements for running that business. The existing machinery was both cumbersome and inefficient and resulted in long delays in getting needed information. Despite the generally liberal support for libraries that existed in the United Kingdom, there was wide discontent with the arrangements then existing for interlibrary loans. In economic terms the distribution mechanism was found wanting and the order fulfillment system was slow since it was poorly organized and in fact provided no incentive for fast turnaround service. In most business operations these two deficiencies alone would usually be sufficient to guarantee failure of the business. When Donald Urquhart developed the idea of a national center to remedy the situation, it was not an attempt to build a huge centralized bureaucracy to satisfy some lust for power. He saw a regrettable void in the ability of libraries to provide information promptly and sensed the deleterious effect this would have on the national welfare. Despite some waspish reaction and opposition in the library community, he persevered and introduced industrial flow processes and good business procedures into the library world. The tremendous success of this venture is well known and provides a bellwether example of the economic principles applicable to libraries in the future.

Another example, born of economic necessity, concerns the recent development of joint efforts to reduce cataloging costs of libraries. In addition, cooperative cataloging as exemplified by the nearly 900 libraries of the Ohio College Library Center (OCLC) program, provides immediate access to cataloging information in contrast to former delays of several weeks. The economy of scale of shared cataloging is such that participating libraries have found existing records for 90% of the books to be cataloged(2). When one considers the redundancy and cost for each library to catalog all of its books independently, it is quite obvious that until OCLC became available in the early 1970's there was little evidence of effective economic planning for the reduction of cataloging costs. Again, as in the case of the National Lending Library, Frederick Kilgour weathered the skeptical comments of the library purists and his rather audacious venture has been a singular success. Former disbelievers are now emulating the OCLC example of system design and on-line access but credit for the vision and drive belongs to Kilgour. In this example the library in the future will find that an economic imperative requires not only the need to cooperate and keep costs in line but also a dash of boldness and good management. The melding of these ingredients with the tremendous aid provided by modern technology are basic to the survival of the library in future years.

A third example demonstrates again how economic considerations are becoming important factors in library operations. The on-line literature searching of abstracting, indexing and other services has grown very rapidly in recent years and with this growth searching costs have come down considerably. An example of this from our Bell Laboratories libraries shows that in 1975 a total of 302 on-line searches averages \$44.00 per search(3) and in 1976 there were 1247 searches at an average cost of \$27.50. The important fact is that we find it more cost-effective to use on-line searching, with its high speed and comprehensive coverage, than to do manual searching requiring high labor costs. This is further evidence of how economics will induce substantial changes in the methods used by libraries in the future. When EURONET is fully implemented, NATO countries will have the same potential for inexpensive information retrieval that now exists in North America.

## LIBRARY MANAGEMENT

As in the case of economics, libraries have been slow to apply management principles widely accepted in the industrial and business communities. Educational programs for management development also have been sadly deficient in the library world. This will change in the future as greater emphasis is given to better management of libraries. Although there has been a growing interest in systems

analysis, flow-charting and feedback techniques, most libraries have been reluctant to use management devices of this sort, primarily because they are unfamiliar in concept and practice. However, as the "motherhood" role of libraries diminishes, the need to use them will increase and we shall find a new emphasis that equates the management of library business with other business enterprises. The value of computing, telecommunications and photographic aids for management purposes will be considered just as essential to the management process as they are today for the information retrieval process.

In addition to management changes, libraries also will find they need more than librarians on their staff. In many libraries it is a requirement that one must have a library degree to obtain employment. In the past this seemed reasonable and served the laudable purpose of insuring trained professional help for library customers. It is still reasonable for many types of library activities but future libraries will require specialists with different training as well. We will find that the library business will be too important to be left to librarians. The need for systems analysts, programmers, data base managers and computer specialists to properly exploit the technology available for library purposes will demand this. The use of scientists, engineers and other specialists for informed interpretation and use of highly technical data files will be a requirement for adequate information support to research and development tasks in the future. The library either will provide this or its franchise will be assumed by some other body and the library will become an archival function. It is likely that most libraries will make the adjustment.

The experience of one library network demonstrates the application of these new tools for management of library operations. An example involved the need to reduce delays in filling library customers' reservations on "high demand" books recently published. In a systems analysis of the problem it became apparent that delays were introduced in virtually every stage of the process from the time of publication announcement by the publisher to the time of request by the library customer. Delay factors were primarily either decisional or operational in nature and were found in placing of orders, following up on nonreceipt of ordered items, cataloging, and other activities associated with getting needed materials in hand and ready for use. More important was that most delays were caused by lack of information required for making decisions and taking corrective action.

A number of ad hoc decisions were made that improved the situation somewhat but the final design included the following:

- (1) Development of a "Collection Profile" for each library in the network. This not only aided in determining priorities for ordering books, but insured adequate coverage to meet network requirements(4).
- (2) Development of a weekly "High Demand" list of recent titles showing the ratio of copies on hand to reservations held for each title by each library.
- (3) Setting up a weekly Telephone Conference call for library supervisors to discuss the need to order additional copies and determine which network library should purchase based on the "High Demand" list.
- (4) Development of a book "Vendor Performance Analysis" to determine which vendors offered the best service.
- (5) Elimination of Cataloging backlog through the use of OCLC cataloging data.
- (6) Development of an on-line system for ordering, claiming, receiving, accounting, cataloging and lending of library materials.

The result is a fully responsive computer-aided system with adequate feedback for making operational and management decisions essential for prompt service to library customers. The bonus is that in the process of study, design and implementation of the system, many outmoded practices and concepts were discarded. This is but one example where management tools and technology reinforce each other and enhance the effectiveness of library services. Libraries in the future will find many additional areas for similar management applications.

#### LIBRARIES WITHOUT WALLS

If there is one attribute that will characterize libraries in the future it will be the off-site use of libraries. This is already apparent in many industrial libraries and it will be increasingly evident in university, government and public libraries. The reasons are obvious and stem from continuing developments in telecommunications, computing and photography. There will, of course, continue to be heavy use of printed materials held by libraries but much less need for people to go to libraries to keep abreast of the literature and to place orders for library publications. Low-cost terminals in homes and offices will bring quick access to many large information banks, including library catalogs, and since information access will be made easier we can expect more demand for information by library users. These and

other developments will cause libraries to change many of their current ways of doing business.

Although marketing as practiced in business and industry is almost unknown in libraries today, we see a major change in the future. Libraries will need to undertake market studies to determine what type of information needs exist and then put together appropriate information packages and bulletins for distribution to potential library customers. Convenient tear-off order forms for the information advertised can then be sent back to the library where computer sorting can be used to facilitate prompt order fulfillment. In addition, libraries will provide custom-made information services on a one-time basis or on retainer in much the same way as provided by information brokers today. It is not unrealistic to expect wide use of home television sets for receiving library information since there are no technical barriers to such use. What is needed is an imaginative program and effective promotional efforts that will bring the idea to life. We should see this evolve in the near future.

In academia there will be continued growth of current trends to bring into coincidence the information powers of computers and libraries, both organizationally and physically. Along with this we can expect also the merging of audio-visual and technologically assisted education facilities into an educational resource center. These changes will have their impact on libraries and should contribute importantly to the spread of individualized learning centers where the full power of information, no matter what its format, can be applied to the educational process. Traditional teaching patterns are hard to change and it will take time for this concept to be implemented but the logic surrounding it is well based and eventually should prevail. Libraries will become much more involved in education per se and will serve as strong adjuncts to the university teaching and research staff. As in other library operations, much of the work will be done through communication centers and provided off-site to library users.

#### TECHNOLOGY AND LIBRARIES

In all of the foregoing the important contribution of technology to future library operation is apparent. This is not a recent phenomenon nor is it peculiar to libraries. However, it has been only about 15 years since libraries first began to look seriously at technology as aids to library work. The unveiling of adequate computing and photocopying services at that time was a major factor in stirring library interest. Until second generation computers and Xerox copiers became available, the principal technical interest of libraries was centered on microfilm. Somewhat more surprising was the failure of most libraries to sense the implication of new technological developments for future library operations. The same applies to important telecommunications advances that were occurring at that time.

There is still considerable reluctance to think technologically about library matters but there is a growing awareness that many of today's library problems are not going to be solved without a large technical input. Certainly anyone concerned with the future well being of libraries must recognize this. Much of the reluctance to use technology stemmed from lack of knowledge of technical matters generally--librarians have not had technical training or experience for the most part. Some of it derived from misguided adventures into computerland and that resulted in unhappy failures which in turn reinforced the doubts many librarians already held. All this is now changing and today the successes far out-weigh the failures. Fortunately the "bandwagon effect" has all but disappeared and technology for libraries is more properly viewed as an economic and operational necessity for conducting library business. With this enlightened perspective we shall look to the next ten years as the decade when libraries generally will make more progress than they have made in the last 100 years. Should there be any doubt of this possibility, perhaps it is sufficient to say that most of what has been projected for libraries in the future has already been done by a few libraries(5).

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# From ETC to ITC, the International Translations Centre

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## SUMMARY

The participation of a greater number of countries of the world in the further development of science and technology will probably make the language barrier stronger instead of weaker. In many cases the scientists of these countries will not use international languages for the communication of their research results. Yet science and technology should not be tied to national boundaries; therefore, tools must be developed to break the language barrier. Translating by computer may be the solution for the future. However, human translating, possibly machine-aided, will still be the most effective tool now.

International co-operation is needed to make optimal use of existing scientific translations. For this purpose the International Translations Centre (formerly the European Translations Centre) was founded in 1960. Possibilities for future expansion and international co-operation are suggested for the near future and on a long term basis.

## LANGUAGE BARRIER

Since the building of the Tower of Babel, the people of the world have been divided, not only by oceans and mountain groups, but by the serious invisible barrier of having to speak in different languages. This language barrier has been the most impeding barrier in human relations. Of course, ways have been sought to bridge this linguistic communication gap, to reduce the barrier of misunderstanding due to language differences. None of the solutions have proved very successful to date. Artificial languages such as IDO, Volapük and Esperanto have only contributed to the problem: that is created more languages for us to cope with. Thus, today, we appear to be further away from the ideal situation than we were in the Middle Ages, when Latin was the common language of the educated people of the world. It would seem logical to assume that with current scientific and technological knowhow, that this problem would have been solved by now, or at least would be soon. However, this is not the case. We live in a time when it is possible to contact a Russian, Chinese or Japanese colleague within a few minutes, just by lifting a telephone. In order to speak to him though, it still takes years to learn his language. Linguistic skill still takes a long time to acquire.

## BREAKING THE BARRIER

NATO in its treaty thought to do something about communication between its member countries. It prescribed in article 14 of the treaty, that English and French should be the working languages of the organisation and, within this organisation that has been the attempted solution. However, it is short-sighted to perpetuate a communication system which applies to only one area. To be of any value to mankind, such a system should be applicable anywhere and everywhere. In this assembly, it is not too strange to use the military situation as an example. In this area of society, it is of the utmost importance that military commanders know not only the strength and the capabilities of their own forces, but also as much as possible about that of their enemy. It is therefore not surprising that NATO, in conjunction with its member countries, has developed a strong military intelligence service which provides current data on activities outside the treaty.

Millions are spent on very sophisticated apparatus used to gain intelligence data about possible adversaries. But there is also information readily available, for which no expensive equipment is needed, which is published in journals and reports but accessible only to those people who can read the language in which the article is written. This demands for translations. In practice this is not as simple as it sounds. Modern computer techniques have not yet reached the stage that translating can be done by the push of a button and a translation of a particular document produced with a flick of a switch. We know that for several years scientists have been working towards such a goal and in some cases in the U.S.A. and in Europe they have made remarkable progress. At this moment we are still a long way off this ideal goal, however I believe that this will be the ultimate solution. Human translations, often computer assisted as is done in the Bundessprachenamt and at the European Economic Communities headquarters in Brussels, are still the only way to solve the problem effectively. The idea to use one language for all scientific publications has not been the solution. This may be possible in NATO, where there are two official languages. There is however, a growing scientific community, outside NATO, to which this rule does not apply.

## LANGUAGE PROBLEMS ARE INCREASING

As new countries become industrialised, more research is done outside the Western area. A first reaction to this expansion may be the belief that the research published in these other languages is not important enough to warrant attention. This attitude does prevail in many places.

The avalanche of published research has grown so much that the less accessible material tends not to be used and the risk of duplication of work and other possible losses is taken for granted. But with this attitude the results of important research may be lost. According to Dr. Engelbert (1), it was possible, at the beginning of this century, for a scientist with the three languages - German, English and French - to read nearly all the important Chemistry publications, because 93,5% of all scientific work was written in these three languages. Today, however, important scientific knowledge in the field of Chemistry is published in more than 50 languages. The Russian language is the second most important language, followed by German, French and Japanese.

But what about the importance, the usefulness of literature written in a foreign language. Dr. Chan (2) says - and I could not agree with him more - "It seems that there are so many variables involved in any attempt to assess the intrinsic importance of foreign language material that no satisfactory indications have yet been derived". The user can only assess the importance of literature to which he is referred, when he has read it. Just because the literature is written in a language he does not master, does not mean that this literature is not important.

When searching through the literature, the appearance of foreign material happens more often now than before because of the increased use of data bases. In these data bases the literature listed is not limited to a certain area or a certain language. According to H. Collier (3), who carried out a count between the years 1970-1975, in the Institute for Scientific Information data base, the U.S.A. journals account for 37% of the journals, European journals for 54% and the rest of the world for 9%. And according to J.A. Schulkes (4), the division of the Chemical Abstracts data base is as follows: West European languages 65%, Russian 25%, East European languages 5%, Japanese 5%. And that those journals are not all written in English and French is obvious. Thus when using data bases, users are very often referred to literature in a language they cannot read. J.A. Schulkes (4) speaks of the use made at the Philips Research Laboratory of the European Space Agency data system, in which 5.5 million abstracts of technological and scientific documents are stored. He says: "As all abstracts are in English, there are no major problems at the selection procedure. Since this system was put to use the need for translations of the original documents has quickly increased". The abstracts having been translated into English have revealed the importance of the original document, hence the increase in demand for translations of foreign works.

#### TRANSLATIONS

The need for translations is thus obvious, but translating is very expensive and very time consuming. Good translators are often difficult to find. Besides knowing the language, translators should also have some knowledge of the terminology of the subject. Such translations can aid the spread of existing knowledge and thereby prevent the duplication of work through ignorance due to the language barrier. For this purpose a wide variety of translation schemes have been set up, from ad hoc translation to simultaneous publishing in two or more languages, including many types of selective translation, abridged translation and cover-to-cover translation. However, the delay and the relatively small range of cover-to-cover translations causes a flow of many thousands of ad hoc translations a year. These cannot easily be controlled, as they are spread all over the world, and are often prepared and available in limited numbers, perhaps in a single copy. In order to prevent this duplication of translating effort and to ensure a better dissemination of existing translations, thus promoting international and national co-operation, several networks of translations agencies, holding centres and international clearing houses have been developed in the U.S.A., Europe and Latin America.

#### THE INTERNATIONAL TRANSLATIONS CENTRE

The International Translations Centre in Delft, The Netherlands, is one of these centres. In 1960 the European Productivity Agency of the Organisation for European Economic Co-operation - the predecessor of the Organisation for Economic Co-operation and Development - sponsored the setting up of the European Translations Centre. The aim of the Centre is to integrate East European and Asiatic scientific literature into Western technical knowledge. It should serve exclusively the scientific and technical cause and be completely unfettered by any political considerations or bias. The object of the Centre was defined as: "To encourage, improve and facilitate the use of literature which has been written in less accessible languages and which is of interest to science and industry, and thereby to promote international co-operation in this field". The Centre works in co-operation with ten national translations centres, and any national or international institution or organisation in a position to contribute to the aims of the Centre. An international Board of Management directs and guides the activities of the Centre, and is composed of representatives appointed by the participating countries, namely: Belgium, Denmark, France, Federal Republic of Germany, Japan, The Netherlands, Norway, Spain, Sweden and Switzerland. However, other organisations, scientific institutes, universities, research centres, translating bureaux also contribute to the aims of the Centre by notifying the Centre of translations prepared by them or for them, so that they can be used again by others.

The main function of the Centre is to keep a central reference catalogue of translations and to run an information bureau which handles requests for and information on translations. The Centre does not prepare translations itself, but acts as a clearinghouse for scientific translations. Its main publication is the monthly "World Index of Scientific Translations and List of Translations Notified to the International Translations Centre". Other publications are: "Translations Journals" - a list of periodicals translated cover-to-cover, abstracted publications, periodicals containing selected articles and multilingual publications - and "Translation News", a journal, which appears irregularly and gives information on documentation of translations. At the end of this year "Translations Journals" will appear under the name "Journals in Translation" when it will become a joint publication of the International Translations Centre and the British Library Lending Division at Boston Spa in the United Kingdom.

Now let us examine some figures about the Centre. In 1976, 8.214 requests for translations were received. Of these, 1933 translations were located, of which 148 were supplied by or via the Centre. In this respect it should be born in mind that the task of collecting translations is not given as a primary function of the Centre.

The Centre has to ensure access to information as to the existence of translations, and the holding and storing of which to be done by other organisations, mainly libraries. In the U.S.A. this is the National Technical Information Service for government sponsored translations and the National Translations Center for the others. In Europe you will find all or nearly all translations into English at the British Library Lending Division and those into German for many of the technical subjects at the Technische Informationsbibliothek and in France the Centre National de la Recherche Scientifique holds most of the translations into French. When quoting numbers of requests for translations, I mean those dealt with at the Delft Centre. Of course we do not know how much information is collected from our monthly publication the "World Index of Scientific Translations and List of Translations Notified to the International Translations Centre". This publication is sent to a large number of organisations all over the world, and all main libraries and the most important research centres are subscribers. And through this publication every month roughly 2000 scientific and technological translations are announced; this means + 24.000 a year, all of which are listed in the Cumulative volume at the end of the year. Five-Year Cumulations are available for the periods 1967-1971 and 1972-1976. The bibliographic details of the translations are now also stored in a computer and we hope to make them available on magnetic tape in the near future.

#### FUTURE DEVELOPMENTS

And so I have come to a future role of the Centre. The main and most important item on which the Centre has now focussed its attention for the near future, is to improve international co-operation in the field of translation spotting. Contacts with other organisations in the same field have been made. For instance a proposal with the U.S.S.R. on co-operation of available collections of translations, exchange of experience, cataloguing techniques, exchange of publications etc. is under consideration. Translations should play a greater role in the dissemination of scientific information, as translations themselves form an integral part of the entire flow of information. I believe that the Centre should not be limited to translations of documents originally published in the so-called difficult languages, but should expand to all languages and should also expand to other subject fields and disciplines, e.g. the social sciences. We are also thinking about the utilization of microform techniques for publishing information, the dissemination of information by subject, the use of on-line retrieval, the standardization of the input formats, and a standard numbering system for translations. In some of these areas we have already made a thorough investigation of the possibilities, in others we are only at a very preliminary stage.

We have to continue co-operation in the international field to overcome the language barrier, which instead of disappearing shows its influence more and more. We may expect that many more countries than at present will contribute to scientific knowledge. In particular I expect contributions to increase from those countries of the so-called third world, Latin America, the Middle East, Africa and Southern and East Asia, as I do not expect they will use English all the time as a means to overcome linguistic barriers. This has not happened in the Old World and there is no reason whatsoever, that it will in the New World. At the very best a limited number of international languages will be accepted: English for the Old World, Spanish for Latin America, Swahili for Central Africa, Arabic for Northern Africa and the Middle East, Russian for the Soviet Union and Eastern Europe and Chinese for Southern and Eastern Asia. However, even the acceptance of these six common languages will not prevent publishing in national languages. Here again we have seen that scientists in the Old World use their home language often enough, and there is no reason to believe, that the New World will follow a different pattern. This is not solely because of nationalistic feeling, if this is what you expect me to say, but mainly for practical reasons. There may be other reasons to publish in the own language, e.g. It is easier to express oneself in one's own language; some research results may be especially applicable to situations in one's own country, for example when sociological matters are involved; and scientists must also keep their fellow countrymen and in particular their money-suppliers informed about their activities. If many more countries start to participate in science, the number of scientists will grow very rapidly, which means, that there will be a greater need for a much wider dissemination of information in at least the six core languages, which I mentioned. This will impose upon us the problem of creating multilingual thesauri with a sufficient depth to include Spanish, Swahili, Arabic, Russian and Chinese. Until now most of our research in creating good thesauri has been based on one single language, English. We may expect, that - with the addition of new countries and their scientists to the pool of science - that the amount of information will grow even more than during the last eighty years. Scientists will become more specialised than at present and the study of psychological and sociological factors will greatly increase resulting in new sciences like psychonomy, sociomediology and ecosophy. And yet again we may expect, that information will be communicated more quickly than at present, that information will be much more specialised than it is now and finally that better tools will be developed for direct access to information files, not references, but to the actual data on a multilingual basis. Tools will be developed not only for retrieving data according to a profile of interest, but according to your level of interest, or even levels of education. Therefore one could ask for summaries of texts (or oeuvres) of various length to be produced automatically in one's own language (or at least one of the six core languages) according to one's profile of interest, level of interest and level of education. This future may seem unbelievable, but in fact it has begun already now with automatic data retrieval from natural texts.

#### CONCLUSION

From what I have said, it is clear that the barrier created when the Tower of Babel was destroyed, still exists, and will influence the free flow of information more and more in the future. We have reduced the problem in NATO and in the Western countries, but worldwide, the problem has not lost its magnitude. With this in view it was not strange that in 1975 the Board of Management of the International Translations Centre decided to change the name from European to International. We hope that we can continue to contribute in the future to a better exchange of scientific information, and thus contribute to a better understanding between the people of the world.

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## ASSESSMENTS OF DEFENSE INFORMATION AND DOCUMENTATION NEEDS

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## SUMMARY

Historically, the Defense Documentation Center (DDC) has been, and still is, a traditional document and bibliography oriented activity. It is responsible for providing the appropriate data and documentation to increase the effectiveness of scientists, engineers, and others within the Department of Defense (DoD) and its contractor organizations, who manage by far, the largest portion of the U.S. Government's budget for the research, development, test and evaluation program. However, it was realized within the past few years that the scope of the Center is too narrow to continue satisfying its user population in today's research and development community. DDC has reached a "crossroad" in its evolution as a major scientific and technical information service center. As a consequence, formal studies have been conducted to synthesize the predictions of user requirements, as well as the forecasts and trends in information technology, into a set of realistic, well-conceived and documented technical objectives for DDC programs in the next decade.

## BACKGROUND

DoD Technical Information Program

Scientific and technical information (STI) is an integral part of the research, development, test and evaluation program of the Department of Defense (DoD). Within DoD, the STI program provides for acquiring, handling, and disseminating technical data and documents or their abstracts, publishing technical journals, preparing and conducting technical meetings and symposia, and disseminating information acquired by all other means, that support DoD research.

The policy related to DoD's technical information program outlines requirements for the timely, effective and efficient conduct of missions related to the pursuit of a well-organized, thoroughly coordinated, comprehensive program. This program provides for the interchange of technical information within the DoD community and its associated contractors, and with other Federal agencies and their associated contractors, to the maximum extent permitted by security.

Of special significance to the program are the DoD requirements concerning the use of modern techniques for information processing, and the design of systems which ensure participation with other information systems within Federal Government activities and the civilian community, engaged in scientific and technical activities. The purposes for these requirements are to ensure continuous and ready exchange of information, and to avoid duplication of efforts and resources.

Current Status of Technical Information Programs

However, such objectives have not been fully achieved. Over the years, duplicate efforts and resources have resulted in the development of storage and retrieval systems for technical documentation and information related to ongoing research efforts. Separate systems, with overlapping data bases, were developed to accomplish essentially the same or closely related objectives. Many computer-based information retrieval systems were developed and operated independently, without considerations to the needs for uniform standardization or compatibility with other systems, or the needs of users. The conspicuous lack of cohesive and effective planning for technical needs, not only in DoD but throughout the entire scientific and technical community, tends to limit the effectiveness of vital communications in the present-day research community.

Emerging Requirements

Today, the DoD technical information program must increase the effectiveness of some 400,000 scientists, engineers, and others in DoD and its contractor organizations, who manage by far, the largest part of the Federal Government's budget for research, development, test and evaluation. It has been estimated, in a report produced by the Office of Science and Technology within the Executive Office of the President, that a ten percent gain in scientific and engineering productivity might be possible with improved information systems. Consequently, the technical information used by engineers and scientists is one of our most important national resources. The effective use of this resource is very important to current and future research and development programs.

Although considerable progress has been made in the management of technical information since 1963, a great deal remains to be done within DoD and throughout the entire scientific and technical information community. Better management, coordination, and participation with other information systems will improve the effectiveness of all the technical information programs throughout the research and development (R&D) community, without increasing the overall costs. The DoD can, and should, play a leadership role in Federal, national, and international efforts to improve technical communications in support of R&D programs. However, this position can be achieved only when a total effort is made in planning programs properly.

### Defense Documentation Center and Defense Information

The Defense Documentation Center (DDC) is a major component in the technical information program of the Department of Defense. DDC's roots go back to 1945, when the Air Documents Division (of the then Army Air Corps) collected technical reports from the Office of Scientific Research and Development, along with the World War II German and Japanese documents that had been screened by the Air Documents Research Center in London, England. In 1947, the Air Force and the Navy Bureau of Aeronautics combined efforts to reestablish the activity as the Central Air Documents Office (CADO), when the Air Force became a separate department from the Army Air Corps. Then, in 1951, the Secretary of Defense combined a number of operations to establish the Armed Services Technical Information Agency (ASTIA) to assume the functions required for the technical information program. The new agency was placed under the management control of the Air Force and the policy control of the Defense Research and Development Board. ASTIA was renamed the Defense Documentation Center in 1963 and placed under the management control of the Defense Supply Agency, with policy control transferred to the Director of Defense Research and Engineering, Office of the Secretary of Defense.

During these years, the mission of the Center was expanded to include responsibilities for acquisition and dissemination of technical documents and information related to four separate research collections in three stages of performances - completed, current, and planned.

#### APPLICATION OF PREVIOUS STUDIES IN STI PROBLEMS AND PROGRAMS

DDC's planning efforts today are being directed toward a marketing approach which advocates satisfaction of user needs. Two formal studies of such needs were conducted for DDC in the mid-sixties. In 1965, the Auerbach Corporation conducted a Phase I (In House) User Needs Study; and in 1966, the North American Aviation Corporation conducted the Phase II (Defense Industry) study. The objectives of these studies were to: (1) develop an understanding of the scientific and engineering process and its technical information needs, (2) define implications for current and future DoD scientific and engineering information systems, and (3) provide information to guide administrative decisions on the scope of DoD scientific and technical information programs.

The studies incorporated demographic data related to the user community, and to behavior patterns concerning needs, acquisitions, and uses of information sources. Included also were the various types of information systems used to obtain scientific and technical information within the R&D community.

As a result of the conclusions and recommendations of these studies, DDC took the following actions:

- Developed the Defense RDT&E On-Line (terminal) System
- Performed experimental programs with selected Army laboratories and selected users in the provision of Selective Dissemination of Information (SDI)
- Produced current awareness bibliographies, recurring management information reports related to three data collections, and initiated the Automatic Document Distribution (ADD) program
- Produced and disseminated cumulative indexes
- Started developing a machine-aided indexing/natural language data base, and
- Began experiments with DoD Information Analysis Centers.

Since those early studies, there have been rapid advancements in the information technology field. This, combined with the increasing complexity in the technologically oriented user environment, demands skillful management and increased awareness of other information resources.

Therefore, to update the available information regarding the needs and uses of technical information, and to ensure current knowledge of advancements since the previous studies, DDC began, in 1974, the process of establishing a well-conceived plan for allocating resources and defining long-range STI objectives. The achievement of this effort will assist in satisfying projected requirements of the user community during the 1978-1988 period.

#### DDC USER REQUIREMENTS AND PLANNING STUDY

##### General Description

A contract was awarded to Auerbach Associates, Incorporated (AAI) in 1975, to assess the current and future needs of the Defense RDT&E community for DDC scientific and technical information services, and to provide a basis for establishing objectives, plans, and priorities for information systems and services over the next 10 years. Their proposal was selected from among eight others by an evaluation team representing various military technical information offices.

In essence, the study was to identify:

- DDC's position today in terms of satisfying its STI mission
- DDC's requirements to plan objectives to accomplish improved information products, services, and systems by 1988, and
- DDC's role in the overall R&D information community in the decade of 1978 to 1988.

The basic study consisted of three surveys followed by an expert panel review to determine the feasibility, desirability, and probability of timing the proposed list of events related to information technology or service which were ascertained during the surveys. The four general phases of the effort consisted of:

- (1) A user survey of DoD and DoD-contractor personnel to provide baseline data on current levels of awareness and satisfaction with information services and time-phased user requirements.
- (2) An interagency survey of selected agencies or activities which are prominent sources of information services, or are active in the information field, to identify their objectives for the next decade in order to define DDC's future interface with the external technical information community.
- (3) A survey of the literature for potential sources of advanced technology that may affect technical information transfer techniques in the next decade.

(4) A technical expert panel evaluation of the data from the previous sources to identify time-phased technical events that are potentially desirable objectives for DDC development efforts.

Each of the survey efforts, and the expert panel review, were published in interim technical reports. The citations and AD numbers of these reports are listed in the Appendix. These reports contain detailed descriptions of the methodology and findings of each phase of the study. The following describes briefly each phase and selected items from the findings.

#### User Survey

A significant phase of the study was a survey of actual and potential users of DDC-supplied information to define current and future needs, identify problems, and to ascertain opinions concerning adequacy of current information products and services. Data from this survey were analyzed to accomplish objectives mentioned in preceding paragraphs.

Equal numbers of personnel were selected for random samplings within 100 organizations representing four segments of the user market: (1) the key DoD/DDC-user organizations; (2) other DoD/DDC-user organizations; (3) key contractor/DDC-user organizations; and (4) other contractor/DDC-user organizations. ("Key" organizations were defined as the top 200 requesters of DDC documents, by volume of requests.)

Within each organization, three groups of interviewees were selected randomly on a proportionate basis, depending upon the total number of persons within each group. These included bench level scientists, management personnel, and information support personnel.

The survey was conducted by telephone after preliminary arrangements were made with each participant. Survey respondents were contacted initially by telephone, asked to participate, and appointments were arranged for the interviews. Prior to the interviews, respondents were provided a packet of cards which contained response alternatives to the questions to be asked during the interviews. Use of the cards helped to ensure valid responses to the highly structured questions which were asked during the actual telephone inquiry, and avoided the expense of face-to-face interviews.

By an overwhelming majority, the users indicated that local libraries were their first choices for sources of information, and that distant facilities (such as DDC) were among the last. The findings suggest that DDC should:

- Concentrate its efforts on serving end-users through local libraries or information centers
- Increase decentralization or regionalization of its services, and
- Expand use of remote, on-site access devices such as on-line terminals.

There was a decided current- and predicted-need for improving the quality and usefulness of the response or product of the information service. This, coupled with an almost universal finding among users that there were "disadvantages" to the format in which information is obtained, indicates that DDC should move from the current practice of providing only bibliographic, document-oriented services, to more specific information and factual services.

Most users were unaware of the costs of information services. On the other hand, user responses indicate clearly a willingness to pay slightly more money, than such services presently cost, for improved quality (such as more precise, targeted responses) and reduced response time.

Their lack of awareness concerning most DDC services, and information resources in general, indicates a need for improvements in DDC's marketing, information and education programs.

#### Interagency Survey

This survey concerned personal interviews with key persons within selected organizations responsible for information transfer programs. These persons either provide information services or are innovators in information transfer techniques. Fourteen organizations were contacted, including, for example, national services such as the Energy Research and Development Administration (ERDA), National Aeronautics and Space Administration (NASA), National Bureau of Standards (NBS), National Technical Information Service (NTIS), National Library of Medicine (NLM), and some intra-DoD STI activities.

Basically, three general topics were discussed in the one-hour interviews. These were: (1) current operations within each activity, (2) future plans for each activity - by 1988, and (3) the organization's role in the overall R&D information community in the decade 1978-1988. The objectives of these questions were to define the current and projected STI environment external to DDC, and to identify those STI interfaces and problems that will affect DDC's posture in the future STI transfer environment.

Following are some observations and implications arising from the interagency survey:

- The interagency environment consists of independent and often insulated activities, most having a mission-oriented charter that focuses their interests upon specific groups of users. Similarly, it is clear that DDC's primary mission is to serve the DoD R&D community. Its role within the interagency environment is a secondary responsibility; and assistance in the advancement of information processing on a national scale must be viewed as a tertiary responsibility.

- Much can be done to exploit the full potential of available technology in support of STI processes, although technological problems are not as significant to independent agencies as organizational and economical factors. Nevertheless, these organizations should take advantage of the opportunities to coordinate and communicate in the development of improved information processing techniques.

- The major information and documentation centers acknowledge the value to be derived from developing information processing standards, but no real support will be given to compromising existing conventions

unless significant local advantages are realized. Conflicts over present processing standards, parochial management interests, and the issue of public-versus-private rights to information will continue throughout the next decade.

- Localized facilities, such as libraries, are expected to become a vital component of information-providing organizations. The majority opinion was that local facilities staffed by trained personnel can provide the end users with a higher quality of service than can a large, centralized facility.

- The true costs of information processing is unknown at the present time. Another unknown factor is the potential savings to be gained through effective information utilization. Although information has both a subjective and pragmatic value to its users, these values are difficult to measure now. DDC and its peer agencies will benefit by the development and application of econometric measures to their information services.

- Marketing efforts, including brochures, training manuals, and other user-awareness efforts, have had minimal success in those information agencies where they have been employed.

- A significantly difficult problem exists in access to, or delivery of, the full text of documents. User dissatisfaction is expected to increase as the time span between completion of bibliographic search and document delivery widens.

- There is a trend toward the development of specialized data bases of scientific information, consisting of factual data in computer storage, rather than citations to documents containing facts.

- DDC's major reliance on DoD technical reports for its STI data base is at variance with the policies of most agencies surveyed. DDC should broaden the context of its present services to respond to a wider spectrum of DoD information needs. To accomplish this, DDC must find means of incorporating open literature, fact services, and specialized information resources into its scope of services. It should, to the maximum extent possible, provide single-source access to permit users to query many potentially useful information resources from and through a single point.

#### Literature Survey

The literature survey was designed to provide background material on the current state-of-the-art of information storage and transfer, and trends for the period 1978-1988 which were likely to impact on the Defense community. In all, 68 sources were analyzed. The objective was to glean from the literature a number of predicted events to be considered in the expert panel's review.

#### Expert Panel Review

The Expert Panel Review phase was used to formulate a set of reasonable, time-phased assumptions about future information technological, organizational, and economical factors. For this review, the results of the Literature Survey, the Interagency Survey and an internal review of DDC plans and operations were synthesized into a list of future events that are expected to be especially relevant to the DoD information processing and user communities.

The method used by AAI to conduct the Expert Panel Review was a composite of two Delphi-like approaches to soliciting expert opinion, and consisted basically of four steps:

- (1) Development of a compendium of factual data and potential events, and distillation of these data into a basic list of 50 events.
- (2) (Round I) This original Events List was evaluated by experts involved in information transfer at the R&D, operations, and product-planning levels.
- (3) (Round II) The Events List was modified based on the results of Round I. The new Events List was then reevaluated by two separate panels -- a panel of specialists in information technology (Round IIA) and a panel of individuals in influential positions in the information community who are concerned with long-range information science planning and administration (Round IIB).
- (4) Finally, the results were analyzed to form a description of the future state-of-the-art. Potential short-, mid-, and long-range\* goals were defined, and the events necessary (or desirable) to support these goals were identified.

In the review process, each event was considered in terms of its importance, desirability, feasibility, and probability timing. The individual reactions of the experts to each event were averaged, to give a composite rating for the overall analysis in comparing events against each other. Figure 2 shows examples of some events that fell at the extremes in terms of desirability and feasibility. Figures 1 and 3 show events that fell at the extremes in terms of the time period in which they are most likely to occur.

SHORT RANGE EVENTS LIKELY TO OCCUR BY 1985		PROBABLE TIME OF OCCURRENCE
EVENT		
• Automatic retrieval systems with built-in monitoring features		1981
• Standardization of citation formats for literature		1982
• Duplication in acquisition among data bases will be eliminated		1983
• Minicomputers coupled with peripherals will take over many functions		1983
• Personal interactive terminals will be available for less than \$500		1983

FIGURE 1

\*These time phases were defined as: short-range (before 1985), mid-range (1985 to 1995), and long-range (beyond 1995).

MID RANGE  
EVENTS LIKELY TO OCCUR BETWEEN 1985-1995

<u>EVENT</u>	<u>PROBABLE TIME OF OCCURRENCE</u>
<u>Most Desirable and Most Feasible</u>	
• Most technical information retrieval by dial-up communication lines	1986-1990
• Facsimile transmission competitive with postal service in cost	1987-1995
• Paper will be replaced as primary numeric storage medium by digital media	1988-1995
• Standardized citation and abstract formats	1982-1986
• Accessibility of many data bases through a single terminal	1986-1994
<u>Least Desirable and Least Feasible</u>	
• Computers designed specifically for bibliographic storage and retrieval	1984-1988
• Paper replaced as document dissemination medium by full text digital media	2003-2028
• One interdisciplinary subject vocabulary	1993-2000
• Federal technical information services to become self-supporting	1987-1992
• Dissemination of full text of documents precluding need for abstracts as either announcement or retrieval devices	1993-2004

FIGURE 2

LONG RANGE  
EVENTS JUDGED TO TAKE PLACE BEYOND 1995

<u>EVENT</u>	<u>PROBABLE TIME OF OCCURRENCE</u>
• Paper will be replaced as document storage medium by full text digital media	1997
• Access to full text data bases will replace abstracting and indexing as searching tools	1997
• Standardization will allow data bases to be merged into a single file	2000+
• Paper will be replaced as document dissemination medium by full text digital media	2000+

FIGURE 3

Following are some of the basic trends in information transfer for the years 1978-1988 that were highlighted:

- Major advancements in information processing technology are expected before 1985. There should be interim progress in the areas of standardization, multiple data base access, and interactive search capability.
- The greatest potential area for increased scientific and technical information service is in supplying factual data services.
- Eventual interdisciplinary data resource accessible to individuals through single access points are likely.
- Large-scale computers designed specifically for textual information processing are unlikely. Peripheral and decentralized special purpose units, however, are desirable and feasible. Examples are the Optical Character Recognition (OCR) and word-processor input devices for converting documents to digital form at the source. However, it is unlikely that either of the above will be widespread before the late 1980's. This technology will lead eventually to complete electronic control of information processing.
- All expert panelists stressed the need for users to have access to comprehensive information resources, and that access to such stores must be direct and simple to use.

#### Study Results

Of course, the purpose of these efforts was to synthesize the predictions of user requirements, as well as the forecasts and trends in information technology, into a set of realistic, well-conceived and documented technical objectives for DDC programs in the next decade. The final report was to structure these findings in a manner which can be employed by DDC to generate its long-range technical and management plans.

The final report of the AAI contracts was prepared in two volumes, the citations to which are also included in the Appendix. I will not attempt to explain the findings as conveyed by the final report because I have already presented many of them in the discussion of various phases of the study. The most significant problem areas, or forecasted events, recurred in the results of each phase as well as in the final summary.

In the final report, these areas were distilled into a manageable set of action items which, in the contractor's view, DDC should pursue in order to enhance the scope and responsiveness of its STI service to the DoD R&D community. Specific STI objectives, and the component tasks necessary for their accomplishment, were described. The interrelationships and/or interdependencies of these actions were identified. A time-phased implementation plan was presented to include anticipated DDC capabilities and resources, as well as the forecasted evolution of the supporting technology for the time period 1978 through 1988.

Now, the study having been concluded, the real question arises--Of what value is all of this to DDC? First of all, we feel that AAI performed a very effective and creditable job of acquiring and analyzing significant data and opinions related to current and future requirements and trends for STI transfer. The

reports resulting from this study provide DDC a very sound basis and rationale for use in considering the direction or emphasis for future programs, and in planning long-range investment or development activities. Obviously, we do not plan to follow the contractor's proposed programs to the letter, but they do provide well-evaluated and useful recommendations for specific actions to be taken. In terms of long-range activity, reasonable estimates of the time frames were included in which DDC should act to take advantage of evolving technology.

There is another significant usefulness of this type of study. To paraphrase an old expression, "If you cannot be a prophet in your own house, at least you can have a consultant come in and endorse some of your own convictions." This is especially true for such recommendations as--increased DDC support to local or intermediary activities, such as technical libraries (as opposed to concentrating on direct interaction with end users), increased involvement with information analysis centers as a major integrated subset of the DoD STI community, and expansion of our data base activity to include more comprehensive coverage of all STI relevant to the R&D community.

We have found very useful and appropriate also the goal-oriented program structure upon which AAI formatted recommendations in the final report. Subsequently, we have adapted and applied this structure to DDC's program planning, which involves a similar framework of broad, mission-oriented goals and supporting objectives.

#### APPLICATION TO DDC PROGRAMS AND PLANS

##### Development of Long-Range Goals and Objectives

Using the results of the AAI study as a base, DDC is proceeding to develop a comprehensive program and long-range action plan for providing STI services and support for the DoD R&D community. A small task group was established in DDC to identify and define general, but comprehensive, STI service and technology related goals toward which the Center must aspire, if it is to perform its STI transfer mission adequately in the years to come.

The first step was to reevaluate our existing program management and planning structure, and reorient it in terms of broad mission and STI-service-related goals for DDC to achieve in fulfilling its role as a major DoD STI Center.

The task group used the AAI study reports for its analysis. In addition, the group used such source data as relevant Department of Defense STI program regulations and guidance documents, several internal DDC study and requirements documents, and several reports proposed by DDC user groups. Notable among the latter were reports prepared by the Washington area Committee on Information Hangups and the Los Angeles Regional Technical Information Users Council. (These are regional user groups consisting of representatives whose organizations are some of the major government agencies and government contractor activities.)

Two basic elements of DDC's overall program were identified--the first being an Operational Program which involves the routine and continuing operation and management of the Center, and provision of programed levels of products and user services. This represents the major share of our concern and resources. Operational program goals and objectives relate directly to our primary STI products and services and the current and projected levels of workload, performance or production quality and quantity.

The second is a small, but highly scrutinized, Applied Technology Program for identifying, developing, and implementing new STI transfer techniques and programs. This is the investment or development-type activity needed to ensure continuous evolution and growth in levels of STI service, and commensurate improvements in information processing techniques, through the application of available information, equipments (computer/micrographic), and management technology and concepts. It is the scope and direction of this program to which the findings and recommendations of the AAI study are to be applied.

What evolved was a description of a DDC STI long-range Applied Technology Program in terms of 17 goals grouped into three broad categories, called Goal Areas. (A goal is defined as a broad, usually unquantifiable statement of an aim, or desired end-result toward which effort is directed.)

The first Goal Area included those goals related to significant improvements in: (1) the quality and timeliness of STI operations, (2) the productivity of existing DDC STI processes to free resources for support of the expanding scope of activities, and (3) the responsiveness to changes in user requirements. These goals are shown in Figure 4. Included with these goals are objectives to increase decentralization of input responsibilities and functions, decentralization or regionalization of output functions, increased emphasis on serving local information centers or libraries, automation of labor intensive processes, and shared-cataloging and other support services to technical libraries.

The second Goal Area involves a number of goals related to expanding the number of information services and resources made available to the DoD R&D community by or through DDC. This is a key group of goals for the future. As shown in Figure 5, this area includes many of the concepts and recommendations considered most critical and reported most frequently in all phases of the AAI study--

- Interagency/inter-system compatibility
- Access to evaluated or factual data
- More comprehensive literature coverage
- Single point access to multiple information resources

The third Goal Area, Figure 6, represents the application of advanced or evolving technology to STI transfer processes, and provision of new types of products and services.

Using this structure, DDC established mission and program goals to apply STI technology to both current and future operations. We are now in the process of formulating a comprehensive long-range management plan that integrates the requirements for expanding operational services, the expected impact of evolving STI technology, and the changing concepts of STI service. In preparing the plan, goals are designed to include

corollary objectives. (An objective is defined as a tangible, measurable result or intermediate purpose identified as a means of achieving a goal.) In our Applied Technology Program, the goals, and their supporting objectives, serve as the basis for a project control system under which new projects and tasks must show direct relevance to one or more program goals.

GOAL AREA I  
IMPROVE EFFECTIVENESS AND EFFICIENCY OF STI PROCESSING

- Improve the Efficiency of DDC Product and Service Processing
- Eliminate Duplication Among DoD STI Processes
- Improve Currency, Accuracy and Completeness of DoD STI Data Bases
- Improve the Quality and Responsiveness and Timeliness of STI Services
- Upgrade DDC Resources to Respond to Changes in Mission, Requirements, and State-of-the-Art
- Monitor User Acceptance of and Requirements for STI Products and Services

FIGURE 4

GOAL AREA II  
INCREASE ACCESS TO AND USE OF STINFO

- Expand the Scope, Access to, and Uses of DDC Systems and their Compatibility with Other STI Systems
- Develop Means to Access Evaluated Data Files and Information Analysis Services
- Increase the Number of Active DDC Users and Awareness Within DoD of STI Resources
- Increase Comprehensiveness of DDC Data Bases and Improve Access to Pertinent R&D Literature
- Develop Programs to Transfer Research Results and Technology Between DoD and the Civilian Sector
- Provide a Single Source of Information About Potentially Useful Sources of STI

FIGURE 5

GOAL AREA III  
APPLY ADVANCED TECHNOLOGY TO STI PRODUCTS AND SERVICES

- Apply Advanced Techniques and Devices to Document Processing, Reproduction, and Dissemination
- Establish a Network of Information Systems and Other STI Resources Within DoD
- Develop Techniques for Automatic Abstracting, Extracting, and Indexing, and for Accessing Information-Bearing Portions of Documents
- Provide Advanced Computer and Communications Capabilities for DDC STI processing, Interagency, and Intersystem Networks and Computer Resource Sharing
- Develop Cost Effective Alternatives to Primary and Secondary Distribution of Documents, Document Announcement, and Product Delivery

FIGURE 6

CONCLUSION

It is too early to tell how much of this plan will materialize. To use the old cliché, DDC is, in fact, "at a crossroad" in its evolution as a major STI service center. Historically, DDC has been, and still is, a traditional document and bibliographic-oriented activity. We recognize now that this scope is too narrow and will not continue to satisfy our user population. We must develop techniques for ensuring more comprehensive data bases, to provide information services (rather than documentation), and to offer access to other STI resources. We must seek more expeditious, yet practical, methods for serving the ultimate user, presumably through local information activities. We have initiated a major system redesign and computer procurement effort, of several years duration, to improve our response capability to the increasing and changing requirements. And, we are grappling with the problems of interagency networking, with broad, easy access to information sources, while protecting the security of the classified and sensitive data to which the same users also require access.

The solutions to these and other problems depend upon our ability to assess, plan, and manage properly, a STI program that satisfies the information needs of the DoD R&D community. I feel that the long-range STI requirements and the planning study have provided valuable insight for our management staff to discern the needs and expectations of our user community, and those of our peers in the information business, as well as to the technological trends and expectations. We are using this opportunity on which to base our re-evaluations in perceiving and directing our STI programs and plans for the future.

ACKNOWLEDGEMENT

I wish to acknowledge the work accomplished by Mr. William M. Thompson and Mrs. Florence Parker in preparing this paper.

## APPENDIX

List of reports prepared for DDC by Auerbach Associates, Inc. --  
All under the main title, "DDC 10-Year Requirements and Planning Study"

- Final Report, Volume 1: Executive Summary, 13 Jun 76, AD-A024 700
- Final Report, Volume 2: Technical Discussion, Bibliography, and Glossary, 13 Jun 76, AD-A024 701
- Survey Plan, 15 Aug 75, AD-A022 300
- Literature Survey Report, 17 Oct 75, AD-A022 301
- Interagency Survey Report, 12 Dec 75, AD-A022 302
- Expert Panel Review Report, 31 Dec 75, AD-A022 303
- Survey Results Report, 14 Mar 76, AD-A022 304

## Data Base Sharing in the EURONET Environment

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### Summary

The EURONET project is now in its implementation phase. Detailed preparations are underway to offer users on-line access to some 100 different data bases on over 20 host computers via EURONET. This paper reviews the achievements to date and work in progress, including the general design features and installation of the telecommunications network, data base developments, a proposed common command language and multilingual aspects. A provisional list of data bases to be made accessible through EURONET is presented, together with the names of the host computers on which they will be mounted. The paper goes on to review key principles and policies defining the framework within which EURONET services will operate and identifies factors affecting the sale of data base services for which it is hoped to achieve some harmonisation within EURONET.

### 1. Background

On 24 June, 1971, the Council of Ministers of the European Communities passed a Resolution, which defined basic Community policy for the coordination of activities in the field of scientific and technical information within the Member States. This Resolution explicitly referred to the desirability of establishing a 'European documentation and information network', stating that: "..... in order to achieve economic, scientific and technical progress it is important that scientific, technical, economic and social documentation and data should be made available by the most modern methods to all persons needing to use such information, under the most favourable conditions as regards speed and expense ....".

After several years of complex consultation between the Commission and the Member States, the principles of the Resolution were made concrete in the form of an Action Plan, which was adopted by the Council of Ministers on 18 March, 1975. This Action Plan covers the period 1975 - 1977 and has an overall budget of around 7 million units of account (approximately 8.8 million U.S. \$). The main strategies of the Action Plan are based on achieving coordination among the Member States in three broad areas:

- . Development and creation of systems in the various subject fields
- . Creation of a shared network for providing on-line access to information services
- . Development of skills and tools in information technology.

The EURONET project is centred on the second of these areas, but does embrace many aspects of the other two also, for example promotion of efforts to establish on-line Community services in certain subjects. Its aim has been defined as the provision of an efficient and effective on-line Community-wide service to users of scientific and technical information under favourable economic conditions.

### 2. EURONET Progress

Although the first Action Plan runs until the end of 1977, it is already possible to identify some significant achievements stemming from the EURONET project:

#### 2.1 Telecommunications facilities

Contracts were signed in December, 1975, whereby the nine PTT administrations of the Community's Member States agreed to install and operate a data communications network for EURONET.

The agreement with the PTTs represents an important milestone in European data transmission, in view of the following facts:

- it aims at establishing international data transmission facilities specifically for scientific and technical information
- the nine PTT administrations of the Community's member states are implementing a common technology
- the agreement makes provision for the EURONET telecommunications network to become the basis of a general purpose PTT-operated Community data transmission network
- other benefits are emerging with regard to standardisation of computer/telecommunications equipment and procedures. For example, the EURONET project has played a key role in the development of the X25 interface and is the major influence in bringing about a standard terminal protocol, ESP (32).

Earlier this year, a consortium of contractors was selected by the PTTs to implement the telecommunications network for EURONET. The consortium selected is SESA-LOGICA, CARADATA, ITALSIEL, CHRISTIAN ROVSING and SAIT. The detailed design work is still underway, but the broad characteristics of the network are:

- packet-switching technology, based on an adaptation of the TRANSPAC network, which is in the course of development and which will form the French national public data network
- 4 switching nodes, interconnected by 48 Kbits per second lines, located in Frankfurt, London, Paris and Rome
- access facilities for terminals, located at the switching nodes and in Amsterdam, Brussels, Copenhagen, Dublin and Luxembourg
- the standard interface defined in the CCITT recommendation 'X 25' will be used for connecting host computers (or any packet-mode terminal).

Implementation of the network is scheduled for completion by end-1978.

## 2.2 Common command language

Experience shows that users find difficulty in changing from one interactive system to another. Since a major benefit of EURONET will be the availability of many different systems via a single access point, a study has been undertaken to examine possible ways of alleviating the problem of multiple command languages. The study has concluded that a common command language for on-line interrogation of data bases via EURONET is feasible. It is intended to implement the proposed common command set on certain systems in the near future and to extend this implementation gradually to other EURONET hosts as experience is gained.

## 2.3 Multilingual aspects

As a result of the work undertaken within the first Action Plan, a specific, separate programme of actions has been launched. These actions include the creation and implementation of multilingual tools, such as the compilation of multilingual vocabularies in selected subject fields, the creation of terminology data banks and the development of automated translation systems.

## 2.4 Data base development

The EURONET project has provided a stimulus for the development of several cooperative data bases. Notable among these are inventories of environmental and agricultural research projects, and a data base on the economics of energy.

## 2.5 Harmonisation of conditions for data base supply

Efforts are underway to promote voluntary harmonisation of the conditions for supply of data base services via EURONET. Among such efforts is a set of guidelines for cooperation between data base suppliers and host organisations, prepared by the International Council of Scientific Unions Abstracting Board for the Commission of the European Communities. These guidelines include consideration of such topics as: definition of data bases and their derivable services, conditions of use, responsibilities of the host and the data base supplier, tariff schemes, etc. It is hoped that these guidelines will be a first step towards more general harmonisation of the terms and conditions of supply of information service in the context of EURONET.

## 3. Data base services to be offered

The primary type of service to be offered via EURONET will be dial-up terminal access for on-line retrospective searching of a wide variety of data bases. Although discussions are still underway on the exact mix of data base services to be offered in its initial stages, the broad spectrum of likely services is known. Over 100 different data bases have been offered to be available for on-line access through EURONET on 29 host computers. The provisional details of these offerings are:

<u>Host</u>	<u>Location</u>	<u>Data Bases</u>
1. British Library (BLAISE - British Library Automated Information Service)	London area	UK Marc, US Marc, Medline, Toxline, Other British Library data bases.
2. Infoline	London area	CAS, INSPEC data bases, and other mainly UK data bases.
3. Computer Aided Design Centre	Cambridge	Engineering design.
4. National Computing Centre	Manchester	Computing Hardware, Computing Software, Computing Services, Computing Education, Computing Literature, Computer Installations.
5. Belgian Ministry of Economic Affairs	Brussels	INIS
6. DIMDI/FIZ 1	Cologne	Biosis, Cancerline, Poisons data bank, Excerpta Medica, IDIS (Social Medicine) CAB Index Veterinarius, International Pharmaceutical Abstracts, Hospital Affairs,

<u>Host</u>	<u>Location</u>	<u>Data Bases</u>
		Medline, Psychological Abstracts, Science Citation Index (ISI), Toxline, Sport Science.
7. ZAED/FIZ 4	Karlsruhe	Astronomy and Astrophysics Abstracts, Compendex, Energy, NTIS, IKK, INIS, INSPEC-Physics/Electrotechnology/Computers and Control, Mathematik, SSIE, NSA, Physikalische Berichte.
8. IDC/FIZ 3	Frankfurt	CAS, Chemical Industry Notes, IDC-Speicher, Dechema, Kunststoffe/ Kautschuk/Fasern, IDC- Patents data bank, Vt B.
9. DOMA, ZDE/FIZ 16	Frankfurt	DOMA mech. engineering data base, ZDE elec. engineering data base, IKF automotive engineering data base, Compendex sub-set (mech. and automotive engineering), INSPEC-Electrotechnology/Computers and Control.
10. ZMD	Frankfurt	AGRIS, Zentraler Datenpool der Agrardokumentation, Food Science and Technology Abstracts, SDIM, Deutsche Bibliographie, and several prospective other data bases from various subject fields.
11. Institut Textil	Paris	TITUS III
12. Institut G. Roussy	Paris	Cancernet Sabir
13. Fédération Nationale du Bâtiment	Paris	Ariane
14. Necker Hospital	Paris	Drugs
15. Thermodata	Grenoble	Thermodynamic data
16. PLURIDATA	Paris	Chemical data banks
17. INRA	Paris	CAB, CAIN, APRIA, Zoology, Bioclimatology
18. French Host	France	Pascal data bases, NTIS, SSIE, ERDA, Medline
19. SDS	Frascati	CAS, SCISEARCH, INSPEC - Physics, Electro-technology, Computers and Control, Compendex, NTIS, World Aluminium Abstracts, NASA, Electronic Components, AGRIS, Metadex, Environmental Science Index, Pascal Data Bases, Pollution Abstracts, Oceanic Abstracts.
20. Commission of the European Communities	Luxembourg	Community data bases
21. Datacentralen	Copenhagen	CAS, Food Science and Technology, Medline (through SCANNET), Compendex.
22. CNUCE	Pisa	Data bases on: ecology, geothermal science, iconography, oceanography, legal documentation, fine arts, citation index (Italian authors).
23. CNECA	Bologna	Data bases on: biology, general and inorganic chemistry, astrophysics
24. Supreme Appeal Court	Rome	Data bases on: legislation, jurisprudence, principles of national and Community law
25. Interfaculty Computing Centre	Rome	US Marc
26. Montedison	Milan	Technical and economic data bases on basic chemical industry. 'Access' to the Montedison libraries (bibliographic data).
27. CSATA	Bari	Meteorological data bank (concerning the South of Italy).

<u>Host</u>	<u>Location</u>	<u>Data Bases</u>
28. CILEA	Milan	Data bases on: human sciences, geophysical information concerning Italy.
29. Joint Research Centre	Ispira	Nuclear sciences, material properties and other data bases.

In terms of the product mix that is emerging, about one third of all the data bases on the above list is related very much to the hard sciences, (chemistry, physics, metallurgy, electronics and so on). About a quarter are related to medicine and biology and the rest are distributed rather unevenly over various subjects, such as education, agriculture, law and environment. An important point of concern is the identification of gaps. At present there does seem to be a deficiency in the number of data bases useful to the non-research side of industry. Patents are one example, but also other areas like product information, market research data and so on seem to be inadequately represented at present.

Further analysis of the list indicates that, of the hundred or so data bases there, 14 are in fact offered more than once. Of those 14, eight are of United States origin, the others being mainly European, although one or two are of an international nature. Two of those 14 data bases are offered three times, and in fact four of them are offered four times. So there is some overlap in certain, mainly major, data bases in the offerings represented by the project mix of the hosts. In this regard, it is important to note a resolution which was agreed upon at the Community's CIDST Committee in July, 1976, which included the following statement: "Each Member State and the Commission intending to mount data bases on EURONET will make all necessary contacts with its partners, including the European Space Agency, in order to encourage avoidance of wasteful duplication". There is therefore the basic intention to cooperate with regard to the overall supply of services to EURONET.

#### 4. Principles and policies for EURONET data base sharing

A broad consensus of opinion has been reached within CIDST and the Commission on many of the key principles and policies relating to the provision and use of EURONET services. These principles and policies specifically recognise the different interests of the many parties involved (users, PTTs, host computer operators, data base suppliers, equipment suppliers, the Commission, national authorities, etc.) and have the aim of presenting a balanced set of guidelines within which EURONET information services can develop. Among the important principles emerging are:

##### 4.1 Equality of access

All Community users should be offered ready, unimpeded and non-discriminatory access to and use of information services connected to EURONET.

##### 4.2 Freedom of choice

Every user must be able to decide freely which information centre he will use.

##### 4.3 Price

The price charged to Community users for access and use of information resources connected to EURONET should be as low as economically practicable, easily understandable to users and should be independent of the location of the user (excluding the local telephone charge for connection of users to national entry points to EURONET). It is recognised that the responsibility for fixing the tariff level for a given service rests with the service supplier, but it is hoped that EURONET service suppliers as a whole will gradually harmonize the structures of their tariffs.

##### 4.4 Terminals

Users should be able to use a reasonable variety of terminal equipment, which may take the form of visual display units, teleprinters (TTY compatible) or line printers (200 lines per minute). The technical requirements placed upon user terminals should be kept to a minimum.

##### 4.5 User convenience

Special care should be taken with regard to the convenience of users, for example concerning arrangements for using the network, referral and passage of users from one host computer to another, etc.

##### 4.6 User evaluation of services

Appropriate means should be provided for assisting user evaluation of services, handling suggestions and complaints, and generally consulting users on a regular basis.

##### 4.7 User support

EURONET host computer operators must be prepared to make available sufficient user support to ensure adequate accessibility to their services in all Member countries. It is recognised that EURONET is mainly intended for improving on-line access to data bases. However, the means by which EURONET can also help users who cannot afford on-line access should be studied. Furthermore, it is planned to provide a user referral facility to help users find data bases appropriate to their needs.

##### 4.8 Standardisation

Standardisation should be introduced gradually and by voluntary cooperation among those concerned.

It is expected that such guidelines developed in the context of EURONET will also have an important influence in promoting cooperation in general among the Community's member states in the field of scientific and technical information.

## 5. Some key factors involved in the sale of data base services via EURONET

The multiplicity of parties involved in the provision and use of services via EURONET could imply a complex contractual structure. Every effort is being made to keep arrangements as simple as possible and to harmonise wherever possible. Among the items which need careful definition but which do offer opportunity for harmonisation, especially with the user in mind, are:

### 5.1 Definition of services

This is an essential starting-point, but is usually poorly defined. The type of information required for the definition is: content and format of data base, updating frequency, available software functions, output possibilities, etc. Defining 'quality' of service is a problem and a practical solution is normally for the supplier to give a contractual assurance of his 'best efforts'. A crucial point which can and should be defined, however, is the period of notification for changes in the service (e.g. software, data base content, complete withdrawal).

### 5.2 Conditions of use

It is normal for the data base supplier and the host computer operator to place certain restrictions on the use of any retrieved data, notably with regard to copyright and reproduction of output.

### 5.3 Liability

The user normally has to accept a disclaimer for responsibility from the suppliers involved for any consequential damages arising out of errors or omissions in the data base and/or software. More surprising perhaps is the frequent disclaimer for interruption of service and reduced performance.

### 5.4 User support

Important conditions of sale for the user should be specifications of the minimum levels of support from the suppliers, especially with regard to initial training and installation, user manuals and general back-up in the event of problems. It is usual for charges to be applied for these areas, though approximately at cost.

### 5.5 Royalty payments

Built into the fee paid by a user to a host operator is normally some charge for use of a third party's data base. At the present time this charge varies widely with regard to both the method of calculation and the resultant price level. The method of calculation may, among others, be based on:

- connect hour charge
- 'hit' charge (either actual hits or percentage of hits in relation to total file)
- fixed fee per search.

These naturally give rise to wide variations in actual prices for comparable searches and there is a real need for harmonisation of approach here.

### 5.6 Billing and collection procedure

In a multiple-host, multiple-data base network, the user faces the possibility of receiving multiple-bills every time he uses the network. In the United States, the approach has typically been to combine the fees for the network operator, data base suppliers and a single host on to a single bill, with a single collection procedure. In Europe, with multiple-currencies, the situation is less straightforward and the advent of EURONET with multiple-hosts means that the problem could be very complex. There will be a real need to have a simple procedure which combines as far as possible all the charges related to a given on-line search and to be able to make a single payment in local currency.

It seems to be in everyone's interest to simplify the contractual structure as much as possible, not only to have consistent clauses between suppliers of the same type but also between different groups. For example, the 'liability' clause could be more or less standardised between the user and the host operator and between the host operator and the data base supplier. In this way, it is hoped to build on such common clauses to obtain general conditions of sale for as much as possible of EURONET services.

## 6. Outlook

The date of entry into operation of EURONET is foreseen for end-1978, at which time Community scientists and technologists are expected to instigate on-line enquiries at the rate of several hundred thousand per year via the network. However, EURONET is already acting as a focal point for a wide range of key information activities at Community level.

The current Action Plan covers the period up to the end of 1977. A second Action Plan for the ensuing period is in the process of discussion. One of the major goals of this draft second Action Plan is the provision for continuity of EURONET development and operation. Hence the forthcoming years should see the emergence of a major force on the Community scene of scientific and technical information, as EURONET provides users with on-line access to a wide range of data bases and host computers.

## LE BUREAU NATIONAL DE L'INFORMATION SCIENTIFIQUE ET TECHNIQUE (BNIST)

by Mr J. Michel, BNIST, Paris

Founded in February 1973, the BNIST (National Scientific and Technical Information Bureau), is an interministerial organization attached to the Ministry of Industry and Research.

The BNIST is responsible for :

- proposing to the Government a suitable national policy with regard to the dissemination of scientific and technical information,
- taking the necessary steps to implement this policy,
- carry out the policy liaising with the various Ministries concerned.

The BNIST includes a President, a Steering Committee and a permanent secretariat which, under the direction of Mr J. MICHEL has the task of preparing and following up the various courses of action submitted to the Committee for its approval.

The BNIST has a budget to finance its activities (7,5 MF in 1974, 9 MF in 1975 and 9,5 MF in 1976). This enables it to issue contracts for specific activities of short duration (2 to 3 years), to public or private organizations. The task of the BNIST is to incite action, and its budget is therefore used to provide scientific and technical information which acts as a stimulus in support of normal financing. In 1974, 49 contracts were passed by the BNIST and 63 contracts in 1975.

#### I - SCIENTIFIC AND TECHNICAL INFORMATION FOR INDUSTRY AND RESEARCH WORK CARRIED OUT SINCE 1973

The effort of BNIST in this field concerned the following points :

- a national network of scientific and technical information split into specialized networks to correspond to the broad sectors of professional and economic activity : chemicals, textiles, agriculture, nuclear, energy, metallurgy, medicine, electricity, environment, etc.

Within each sector the BNIST coordinates the activities of existing centers and develops not only the supply of bibliographic references, but the implementation of data banks and the availability of evaluated and synthesized information.

Each sector is organized in relation to the realities of the international situation : development of french expertise in a priority field (energy) use of a data base which benefits from extensive facilities (as Chemical Abstract in chemistry), a participation in a worldwide organization with international cooperation (INIS for nuclear activities - AGRIS for agriculture). A multilingual policy is encouraged by BNIST in all cases in order to make the french documentary material available to an international audience.

- general services open to scientific and technical organizations :

1. SOS DOC : A national referral service, which is at present helping between 350 and 400 researchers in their quest for information sources (documentation centers, professional bodies, etc).

2. Regional Agencies, created at Nantes, Lyon, Toulouse to form a relay system between various organizations and the information sources. These agencies carry out specific studies, in particular for the Small and Medium Size Enterprises, in collaboration with industrial relations delegates, regional branches of the INPI (Patents), etc.

Their implementation has received the enthusiastic support of chambers of commerce and industry.

- a policy of computerized information and networking : the use of data processing networks will solve the problems of "regionalisation" of information (decentralized terminals) and of "democratization" (a light terminal costs 20 000 F). The BNIST has accorded financial support to the Cyclades network to which it has linked the Thermodata data bank (chemistry-metallurgy) and the ASE (Agence Spatiale Européenne - European Spatial Agency) at Frascati, data base which processes the broad american data bases. In 1976, other french data bases will be connected (textiles - building industry - etc.) to Cyclades which shall itself be linked to the Euronet European network, due to be set up at the beginning of 1977.

BNIST has also taken part in the creation of data banks (Thermodata at Grenoble, a data bank for medicines at the Necker Hospital) and in the development of an automatic translation system (TITUS) for translating abstracts in french, english, german, spanish and soon arabic.

Finally, it finances studies on the typology of data banks, documentary softwares, minicomputers, etc., in order to provide users with information to help them solve problems of automation.

- training of specialists and users : BNIST is at present financing a study on the statutes of specialists and future requirements in order to prepare a policy for the training of specialists.

In liaison with Unesco, it is participating in the organization of an annual post-university course. In 1975 a course on multilingual thesaurus was organized in collaboration with the European Communities.

On the other hand, it is supporting special users training sessions for the use of networks and is also preparing a long term plan for users training.

- research in information sciences : the research in information sciences is based on 4 aspects :

- representation and characterization of the information
- the psychosociological aspects of the transfer of information (producers, transmitters and users)
- data processing equipment and tools
- economy of information.

In 1975, 1,3 MF of the 9 MF representing the BNIST budget was devoted to research, 12 contracts were negotiated following a call of tenders issued in 1975.

- international relations : BNIST participates directly or through experts nominated by it, in the work of the main international organizations : the Scientific and Technical Information and Documentation Committee (CIDST) for the European Communities - Unisist (Unesco) - information policy group (OECD) - FAO (Agris and Agris-Tropical documentation system) - International Documentation Federation - ISO (work on standards), etc.

Within the framework of bilateral relations, collaboration with IDCAS (Industrial Development Center for Arab States) in Cairo which is financed by the Arab League will enable the TITUS system of automatic translation to be extended to the Arabic language. (This work will be completed at the beginning of 1977).

## II - SCIENTIFIC AND TECHNICAL INFORMATION IN THE GENERAL INTEREST : PROGRAM OF ACTION

While ensuring the continuity of work begun since 1973, the Chairman of the Committee has placed emphasis on this new approach to BNIST activities. It is a question of making use of the BNIST organization to encourage the development of scientific and technical culture in France generally. This program is principally concerned with :

1. Scientific and technical publications, both from the viewpoint of technical books and periodicals.
2. The use of media (press - television). Here it is a case of reinforcing the communications between press services of research organizations and scientific journalists, to promote the publication of scientific and technical information, to encourage initiative for popularizing (in broadcasts and magazines) this type of information, and to develop new methods.
3. Museums : to ensure their coordination, promotion and modernization.
4. Films : to develop the production of scientific and technical films and to encourage better promotion of existing films.

## TWO YEARS EXPERIENCE WITH AN INTEGRATED NATIONAL SCIENTIFIC AND TECHNICAL INFORMATION PROGRAMME

by

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We are in the middle of implementing the information policy programme of the Federal Government and that means, firstly, supporting existing information services and institutions, enlarging them, co-ordinating them more effectively; and secondly, a very big, difficult and expensive planning period to concentrate information services more and more and to adapt them to the international and European information policy devices. It means giving the information and documentation fields in a country some sort of structure which of course offers certain advantages. In fact, over the last year we have had a tremendous increase in users, mainly of computerised services but also of all kinds of users, and this, I think, is due to better offers of information services to better information institutions.

On the other hand in the last two years we have seen some new ideas or new points of view which stem to some extent from our information policy ideas when we wrote the programme. And I think the most important change is the discovery that information is not only a raw material but a product or a commodity and that commercial and economics aspects come more and more in the picture.

In the very beginning we, and I think some of my colleagues in this group and other groups, started with the idea that documentation and information is something like libraries where the authorities are committed to do something without any problems of selling, pricing, etc.

We also started with the idea that scientific information is mostly or only a matter of science and research — a kind of input to science, a part of science, belonging to science departments. In the meantime we have become more and more aware that we are in the middle of a commercial field like energy, like products, like raw materials and, as a consequence, we are in the middle of the same problems of selling, markets, branches and so on. We have discovered through the greater power of information activities that we are faced with some kinds of competition: national competition between industry and the public, competition between national services, European services or non-European services.

We have some problems of monopoly and we have some problems to avoid monopoly in the information field from the point of view of industry or from the point of view of government. We have in the European Community some legal problems when government-supported information products, supported in the same way as oil, butter, bread, etc., conflict with the legal provisions of the Treaty of Rome concerning competition, monopoly, etc. Another very important aspect of competition at present is the competition or the difference between information services and private publishers. This is partly due to the new technologies which enable you to store more and more information and more and more letters in your automated memories. You are right in the middle of competition with the commercial interests of this whole sector of printing, publishing, and mass media. Moreover, the general public has some restrictions against the monopolistic power of governmental financed and controlled information systems and dependences of information technologies like computerised test storage and handling broadband and facsimile technology, ultramicroform, reprotechnique etc. — whether or not this is justified.

These problems are magnified by the new networking technology where in principle everybody is able to use a national network, or through a national network, international networks, and that of course is a very new approach and a new challenge to users to use more and more computerised information systems instead of printed information services. Nevertheless, in the meantime a lot of users are using printed materials, but to print materials you need more and more computerised devices. Another problem is the question of using microforms and copies. There is real competition between the interests of the users on the one hand and the interests of the publishers on the other. This is a problem where the libraries are concerned and I think it is a very important problem for future information policy.

If information is a product, this will, of course, affect the transfer of technological information to developing countries. We shall have to handle this like other products, and I think that we should realise that this is of great importance in our future discussions about the relations between the so-called "industrialised" countries and the others.

In the implementation of our programme it was finally discovered that other types of information are very much in demand, e.g. not only data banks in the field of science, engineering and technology but also in economics, statistics, products, by-products, consumer products, information services in connection with Technology Transfer, Innovation-Transfer, and so on, and it is for us a very new and difficult problem how to handle this and how to react to user demands. We will have to adjust more and more to a very large clientele in the whole area of society, going across the borderline of science, technology, administration, etc.

## UK DEVELOPMENTS IN SCIENTIFIC AND TECHNICAL INFORMATION

by

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## SUMMARY

This paper reviews the most important UK developments over the last twenty years. They relate to libraries as well as information services, and the paper demonstrates the extent to which decisions on developments have been related to research. Many of the developments described are centred on, or stimulated by, the new British Library. Special attention is given to the growth of library and information systems and networks, to literature back-up services and to reviews of needs for further developments.

## BACKGROUND

1. There are two important features of the UK information scene. First we have a wide diversity of information services, Second, most of these services are based on libraries, which provide library as well as information services.

2. The diversity of information services springs to a large extent from sharing a language with the USA. It has been possible in the UK

- a) to avoid duplication of US effort on major, costly services such as CAS and MEDLARS and so devote resources to services that complement and enrich US provision;
- b) to sustain services that are produced in the UK with a substantial market in both countries and so increase their viability.

3. Users are now thoroughly accustomed to this established variety of services. Many of the services are tailor-made to suit the needs of individual users or small organisations. Some of them are documentation services only - over three hundred machine-readable and other data bases are produced; others concentrate on data, digests, and other analysed services; and others still provide a mixture of services to meet a wide range of needs. Many services are provided personally to a user, or a team of users, and these are particularly well appreciated by both academic staff and practitioners. There is, in all this, some overlap of functions and duplication of effort, which at first sight seems wasteful. However, it has been defended, up to now, on the grounds that it gives users a wide choice between alternatives and enables them to rely on the services that they personally find most helpful. In addition competition helps to keep service organisations efficient and conscious of their users.

4. The second feature of the UK scene is the existence of strong links between information services and libraries. A high proportion of specialised services are located in R & D centres, either within or near to the libraries that serve the R & D staff and their 'customers'. Such libraries provide the literature basis for the information services and often organise the supply of documents to users. Since a high proportion of total expenditure goes on maintaining the libraries, it seems important to treat them as an integral part of the information-transfer process and to give them due attention when planning future improvements.

5. Much of the investment in UK libraries and information services has come from public funds, whether it takes place in government departments, in public agencies receiving most of their money from government, or in private institutions which receive public funds for specific purposes. Government departments have therefore recognised some responsibility for ensuring the provision of information services to meet specific needs. In the past, policies and practices have varied greatly from one department to another and innovations have occurred sporadically and without coordination. But increasingly these developments are forming part of a coherent pattern, with the focus of policy interest in an Interdepartmental Coordinating Committee on Scientific and Technical Information (ICCSTI). There is no intention to create an integrated national plan as in the Federal Republic of Germany, or to centralize as many policy decisions or funding operations as in France. But there is a clear intention to ensure that all necessary responsibilities of government are identified and clearly allocated among departments and agencies, that each responsible organisation is encouraged to work to a positive and consistent programme and that the activities are subject to regular review and coordination by ICCSTI.

## EARLY DEVELOPMENTS

6. The first post-war developments of any importance were, in effect, a strengthening of the structure of specialised services described above. During the 1950s, as part of national efforts matching US Conditional Aid, the government continually stimulated improvements in information services aimed primarily at industry and commerce. Many types of experimental service were encouraged in the grant-aided research associations, and regional organisations were encouraged to harness, pool and coordinate their local resources - including testing and other facilities in laboratories. On this foundation was built, in the 1960s, a large-scale and valuable extension service for small firms, centrally planned and financed and operated locally from technical universities and colleges. A service for small firms still exists, but on a more modest scale now that information resources within industry have become more substantial. The government's development and extension service for agriculture, however, still operates on a large scale and complements the specialised, high-quality abstracting services of the Commonwealth Agricultural Bureaux which are located in the UK.

7. A second form of support to specialised information services came with the creation of the National Lending Library for Science and Technology, now absorbed in the Lending Division of the British Library. Though started only in 1957, this enterprise established within ten years a large enough collection and a fast and reliable enough service of loans and photocopies to become virtually indispensable to UK information services. It now covers all subject fields, collects over forty - thousand journals and receives two and a half million requests a year (12% of them from abroad). Its success enables individual librarians to reassess their acquisition policies and if they wish, to redistribute resources between acquisitions and services to users. Special librarians, and directors of information services, have in general been quicker to use this opportunity than other librarians; but as pressure on library resources grows, the opportunity is being more widely used.

## PROGRESS THROUGH RESEARCH

8. Apart from these early developments, it has become customary in the UK to base innovations and improvements as far as possible on research. For this purpose the Office for Scientific and Technical Information, now the R & D Department of the British Library, was set up in 1965. During its early years there was a widespread belief that information science, a new and struggling subject, was about to enter a period of rapid advance in which fresh ideas for research would emerge spontaneously both from academic institutions and from service institutions well placed to apply the results of research. OSTI therefore operated at first somewhat like a research council, backing mainly unsolicited research through grants. This belief was over-optimistic, however; the flow of research ideas, after a promising start, declined significantly and OSTI came under strong pressure from scientists, librarians and information specialists to take a more active role in identifying important issues requiring research, in establishing priorities among them, in getting the research done and ensuring that the results were understood by decision-making organisations.

9. The biggest single decision, the creation of the British Library, was in an important sense the result of study directed in this way, though the study was conducted by a committee of the Department of Education and Science and was not supported by OSTI. It was an important decision because it brought together in one organisation a wide variety of functions:

- a) Established reference services to scholars in the humanities and social sciences.
- b) Reference, and accompanying information, services to scientists and technologists, especially those in and around industry who combine searches of patents with searches of other classes of literature.
- c) Provision of the British National Bibliography and of services based on it and on the bibliographies of other countries, including shared-cataloguing services.
- d) Lending services both from its own stocks and from those of cooperating libraries.
- e) Provision of information services from its own data bases, or those in which it has rights; joint supply of services with other organisations; and short-term help to independent services for specific purposes.
- f) Conduct and support of R & D, and introduction of new technology to its own operations, where appropriate.

10. The assembly of these functions represents, in effect, an attempt to make the national library a vital part of the national information system and to merge both library and information functions in one national organisation. Nowhere is this merger more evident than in the on-line computing facility due to become operational in April 1977; this facility is to provide both library services of the MARC type, including a shared-cataloguing facility, and information-retrieval services from data-bases in the MEDLARS family.

11. Two important areas of OSTI/BL supported research have been the mechanisation of (a) library and (b) information-retrieval operations. Both sets of projects had as their main purpose the exploration and assessment of the role of computers and related technologies, including reprography.

Both have provided help and decision data for those operating services in the UK - whether library services or abstracting, indexing or data-compilation services. Both have played an educational role - helping users to understand more clearly the existing and potential scope for new technology and the technical, operational and economic problems of using it.

#### LIBRARY SYSTEMS AND NETWORKS

12. The library mechanisation programme has had many significant results:

- a) By producing the mechanised national bibliography, within an organisation which has since become part of the British Library, it has enabled the Library to announce a wide range of MARC services soon after its formation and also to harmonize the production of its own catalogue with the production of the national bibliography.
- b) By focusing attention on a range of MARC-related experiments it has encouraged many libraries to take advantage of the experience gained before designing their own systems. In many cases this must have helped to avoid a good deal of wasteful development.
- c) It has yielded a large amount of reliable information about problems of library mechanisation, which can be translated into guidelines for libraries that are about to create or amend their systems. The demand for this information - and for similar information from other projects - led OSTI to fund an information officer in the library of Southampton University; he is responsible, among other things, for the newsletter "VINE".

13. One important set of decisions requiring data from research concerns the respective functions of local, cooperative and national systems in meeting the varied needs of librarians. For this purpose OSTI and the British Library R & D Department have supported three important cooperative systems in the Midlands, the South West and Scotland. Research started, of course, with batch-processing systems; but the success of the Ohio College Libraries Centre in the USA has created, earlier than expected, a vigorous demand for on-line services with shared-cataloguing facilities. BLAISE, the Library's on-line service described above, will provide these facilities and will be the focus for a good deal of experimental, as well as operational, use. One purpose of this research will be to help determine the relative roles of the Library and of the cooperative organisations in providing and using on-line services; how far they can act as partners in a coordinated network. The same problem of relating national utilities to regional services and networks is being much studied and discussed in the USA.

#### INFORMATION SYSTEMS AND NETWORKS

14. UK research involving computer-based information systems has been in existence for over a decade. As in several other countries, it has included experiments with services provided by batch-processing and, later, on-line systems. The on-line projects have provided valuable data on users' reactions and problems, on operational requirements, on potential demand, and on the costs of providing services on-line. They were conducted partly on small data bases held on-line in the UK, but mainly on services provided by US suppliers through Tymnet. Subsequently operational services have been developed with the introduction of "dial-up" facilities linked to the European Space Agency's Documentation Service and with the opening by the British Post Office of a public service providing access to data bases in Tymnet through its London node.

15. The research, being spread among more than a dozen cooperating institutions, has built up a critical but constructive interest in the possible role of on-line services. Recently this interest has been enhanced by a series of British Library - supported projects in library/information schools, where the potential users of on-line systems in professional education are being explored. One result of this interest is the spontaneous and continuing feed back from users about their needs from on-line services and about problems of using them.

16. Given the creation of EURONET and the continuation of services through Tymnet (and possibly Telenet as well), there is no rush among UK service suppliers to provide a wide range of data bases on-line, especially little-used data bases that are likely to be available from other sources. The British Library will include US MARC, as well as its own MARC data base and the MEDLAKS data bases, in its offer to EURONET. A new consortium, Info-line, intends to offer CAS data bases alongside the UK data bases from INSPEC. Other service suppliers will offer data bases related to computer science/technology and computer-aided design. Further developments are uncertain, but are likely to feature data bases generated in the UK. This approach rests on a careful and continuing assessment of the economics of on-line operations and of the potential scope for them in the UK. For several years to come domestic use of many less-popular non-British data bases will be insufficient to justify the high cost of making them available. It may well be more economic to buy the services from elsewhere. On-line operation must be seen as a matter for international division of effort; unless each country can agree to buy as well as sell abroad, the full economic scope of on-line operation cannot be realised. This is the principle on which EURONET has been launched: it is still a strong motivating force in several member countries.

## CURRENT EMPHASES

17. Apart from on-line library and information systems, thinking in UK is concentrated at present on a number of areas in which serious policy problems are becoming evident.

- a) Inter-library transport. The recent rise in costs and fall in reliability of postal services has caused librarians in several regions to consider, and even experiment with, alternative methods of transporting loans between libraries. Recently the British Library has sponsored a feasibility study for a national transport system and the recommended solution - rail transport from the Library's Lending Division to regional centres and road transport within the regions - is now being tested on a pilot scale in two regions of very different geographical character. If the pilot schemes are both rapid and economic, the Library will attempt to secure agreement among interested organisations, of which there are many, on the scope and form of a national system and on the method of organisation.
- b) Professional education. Interesting changes are taking place in the subject-range and methods of the UK's 16 library/information schools, now that entry to the profession is rapidly becoming a matter for graduates and professional education is being given mainly in first degree courses or in postgraduate courses for graduates from other subjects. Curriculum development has become a major preoccupation for most of the schools over the last five years; and a seminar is to be held this year at which progress can be reviewed and future trends explored. Ten of the schools have recently taken part in an experiment, sponsored by the British Library, to explore the potential use of on-line techniques in the instruction of students on professional courses. This experiment has been judged successful by the schools and by an external evaluator, and the Library now hopes to extend it to the remaining schools and also to intensify it in some schools by the use of intelligent terminals and by specialised experiments in the teaching of shared cataloguing.
- c) Primary communications. This area of policy has leaped into prominence during recent years with the rapid growth of the volume of literature and the cost of printing. The UK has a large number of primary journals, produced by learned societies and by for-profit companies. Many of these are not backed by large management resources and so can benefit from research if it yields, in the end, conveniently arranged information on the wide range of problems requiring management decisions. The British Library is helping to meet this need by supporting a Primary Communications Research Centre which will both conduct studies of practical value and, in consultation with publishers and other 'primary communicators', disseminate the results in suitable forms such as guidelines. The Library is also supporting an evaluated experiment with a synoptic journal and is considering the possible use of editorial processing centres for small publishers in the UK.
- d) User needs and education. Recognising that libraries and information centres need to keep a continuous watch on user needs, the British Library has recently set up a Centre for Research on User Studies, with sufficient expertise to help other organisations adopt sound methodologies for their user studies and, so far as possible, to promote compatible results from these studies where they relate to similar problems. This development has been matched by broad reviews of the needs for service development and for further information research in the main scientific disciplines and fields of application. These reviews have been launched in physics, chemistry, biology and agriculture, and are being conducted by information researchers with supervisory committees consisting of both scientists and information specialists. One valuable result of them is the increased interest shown by scientists in questions of national information policy. Finally, the British Library has been trying to promote studies which can increase the range and improve the methods of user education in the UK. Two aspects are receiving particular attention: the role of travelling workshops, backed by well prepared teaching material; and the problem of introducing user education in schools.

## CONCLUSION

18. I started this paper with a reference to the diversity of services in the UK. One result of this diversity is a firm stress by users on the need for high quality and reliability in the services they use. This is an important pointer to the future since, while many users are interested in innovation and take part gladly in new experiments, as often as not they want to preserve or extend existing quality and reliability more than anything else. For this reason there is much scepticism in the UK about new services such as SDIM and AGRIS I as long as they have serious gaps in coverage or teething troubles in operation. On the other hand there is growing interest in the potential use of reliable on-line services and in the further development of specialised information services, including data banks.

19. Another pointer to the future is a growing interest in resource sharing, especially as funds become scarce in relation to demands on them and as the allocation of staff and spending money becomes an important feature of policy.

Promotion of cooperation between libraries and information centres, both nationally and internationally, is likely to be a major development in future years.

20. Finally, concern with information policy is likely to develop increasingly, not just in central government but in local government, industry and the discipline-based communities of scientists. The review exercises mentioned above have already drawn attention to the complex interplay between various aspects of information policy and have led to a proposal that the scientific communities should be served by a central information policy committee, examining major issues in a coherent way with the help of a technical/research secretariat. Interaction between government and policy - orientated groups of this kind is likely to become a growing feature of the UK information scene.

## Paperless Communication Systems: Putting it All Together

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Summary

We are moving rather rapidly and quite inevitably towards a paperless society. Advances in computer science and in communications technology allow us to conceive of a global system in which reports of scientific discovery and technological development are composed, published, disseminated and used in a completely electronic mode. Paper need never exist in this environment. In a largely electronic world, the individual scientist will use an on-line terminal to collect notes, to compose reports, to build information files, to search data bases, and to converse with other individuals. A scenario for an information system of the year 2000 is suggested in this report, and mention is made of some technological and intellectual achievements that contribute to make the electronic system entirely possible.

One year ago, at a conference in Helsinki<sup>1</sup>, I pointed out that we were beginning to see definite signs of an evolution from a society whose formal communication channels have been based almost exclusively on print on paper to one in which communication will be very largely paperless (i.e., electronic). The Helsinki paper described the problems existing in the present system for the generation, dissemination and use of scientific literature, mentioned economic and other reasons why a move from print on paper seems inevitable, and gave a brief scenario of what a paperless communication system might look like in, say, the year 2000. In the present report I propose to develop the scenario further by describing in more detail the facilities that the future scientist may have available to him through an on-line terminal and pointing to some of the developments and achievements that will contribute to the emergence of the paperless system.

There are, of course, some basic assumptions underlying any discussion of a paperless future. These assumptions are that computers will continue to increase in power and decline in cost, that methods of data transmission will become more efficient and less costly, that new storage devices will make it economically feasible to hold extremely large volumes of text in a readily accessible form, and, most important of all, that computer terminals will be reduced in price to a point at which every scientist will have such a device in his office and, very likely, in his home. All of these developments, which seem highly probable, will produce the communication "structure" that will permit the substitution of the electronic medium for many of the activities and institutions that we now take for granted as operating largely on the basis of print on paper.

The scientist of the future will use his terminal in many different ways: to receive text, to transmit text, to compose text, to search for text, to seek the answers to factual questions, to build information files, and to converse with colleagues. The terminal on his desk will provide a single point of entry to a wide range of capabilities that will substitute, wholly or in part, for many activities that are now handled in different ways: the writing of letters, the receipt of mail, the composition and distribution of research reports, the receipt of science journals, the collection of documents into personal files, the searching of library catalogs and printed indexes, the searching of handbooks of scientific data, visits to libraries and other information centers, and even certain types of professional "conversations" now conducted through the telephone or face-to-face encounter.

In brief, the scientist (or, indeed, other professional) will use some form of on-line terminal to compose text, transmit text, receive text, conduct searches for data or for text relevant to a particular research problem, and build personal information files.

We can reasonably assume that the scientist will use his terminal as a type of electronic notebook in which he records details and observations on his ongoing research. These informal notes, recording background to the study, equipment and methodology used, results achieved, and interpretation of these results, can be entered at any time into a designated "ongoing project file". It is from these informal notes that the scientist will construct his research reports.

The reports themselves, both the reports he may be required to submit regularly to a sponsoring agency and those he wishes to make more widely known through some more formal publication process, will be written at the terminal. In the process of composition, the author will of course draw from the notes he has been compiling in his electronic notebook. He will also have available some rather sophisticated text editing programs, which will make it very simple to make alterations in his text - transposition of sentences or paragraphs, deletions and corrections, and even the wholesale substitution of one word for another throughout the report (needed, for example, if he discovers that he has consistently misspelled a particular word). In addition, he can expect to have available various on-line reference tools, including dictionaries and data banks of various kinds, which will make the task of accurate reporting so much easier. Presumably, too, he will have the capability of electronically copying into his own report any quotations, tables or bibliographic references that he wishes to take from reports already accessible in machine-readable files. In an electronic environment, the problems of checking bibliographic references will be an order of magnitude more simple than is true at present.

When he is reasonably satisfied with what he has written, the scientist may decide that he would like to have his report reviewed, in an informal way, by some of his professional colleagues. He will submit the draft of his text to these colleagues, within his own institution or far beyond it, electronically. This may mean that the text is copied from his personal files (which no-one else may access) into some controlled access file. A message, addressed to those colleagues who are to review the report, is put into

the communication system. The message asks these individuals if they would examine the draft and gives them the information (including a password) that will allow them to access the text. When one of these scientists next goes into a "mail scan" mode at his terminal (which could conceivably be seconds after the message is entered), he will see the message and, when ready to do so, call up the text for examination. The comments of the reviewers are transmitted to the author in the same way.

The author, of course, may choose to modify his report (I hesitate to use the word "paper" in this context!!!) on the basis of the comments received. When it reaches its final form, the report may be transmitted electronically to its final destination. This may be the files of a sponsoring agency or it may be the publisher of some electronic journal.

I do not propose to say much about the electronic journal, because this subject is well covered by Professor Senders elsewhere in this volume, but I suggest that the publication of primary literature in the year 2000 may in fact be a more or less direct electronic analog of the present system. Descriptions of ongoing research projects will get into on-line files similar to those now maintained by the Smithsonian Science Information Exchange. Patents will be stored in machine-readable patent files, dissertations in dissertation files, standards in standards files, and so on. Unrefereed technical reports would be accessible through data bases maintained by government agencies and other sponsors of research.

Science "journals" would continue to be published by professional societies and commercial enterprises. By this I mean that these organizations would build machine-readable data bases, in special subject areas, that would be roughly comparable to the present packaging of articles into printed journals. Thus, I can visualize the existence of an applied physics file, maintained by the American Institute of Physics, a heat transfer file, maintained by the American Society of Mechanical Engineers, and so on. Refereeing would continue, but all communication among referees, authors and editors would take place electronically. The allocation of reports to referees could be handled more efficiently through on-line directories of referees, through automatic scheduling and follow-up procedures, and perhaps through some profile matching algorithm which allocates each report to those available referees whose interests and experience coincide most closely with the scope of a particular article. Acceptance of an article into a public data base implies that the article has satisfied the scientific review process and received the "endorsement" of the publisher. In the electronic world, however, space considerations are less likely to be a major constraint on how much is accepted for publication (Roistacher<sup>2</sup>, for example, reports that the journal *Sociometry* received 550 manuscripts in 1974 but "had room to publish only 39 of them," and this situation is not atypical of many other scholarly journals). This may mean that more articles can be accepted by the first source to which they are submitted by authors, resulting in greatly reduced delays in making research results widely accessible. It may also mean that acceptance for publication need no longer involve a binary decision. Instead, as Roistacher suggests, the refereeing process may lead to the allocation of some type of numerical score to a paper, the score reflecting the judgment of the referees on the value of the contribution. Every article having a score above some pre-set value would be accepted into the data base, the score being carried along with the article. Even the articles falling below the required value might, with the permission of the authors, be accepted into a second-level data base. Once the articles become accessible to the scientific community at large, a form of "public refereeing" becomes possible. The system itself can record the degree of use that a particular item receives, readers can assign their own weights to an article, using some standard scale, and they can place their comments (anonymous or signed) into a public comment file, with comments linked to the identifying numbers of articles. The electronic system, then, may allow an author whose contribution received a low initial rating, from his referees, to be "vindicated" by the reaction of the wider community of scientists.

As suggested in the preceding discussion, the processes by which an article is submitted, reviewed and accepted for publication may not be radically different in the year 2000 than it is in 1977. It seems more likely, however, that a paperless system may force rather sweeping changes in the way that the science literature is distributed and paid for.

It would certainly seem undesirable if the distribution procedures of the electronic system are more or less direct equivalents of the present situation. If a scientist is expected to subscribe for the privilege of accessing one or two data bases, a major defect of the present system - the rather inefficient way in which reports of science research are packaged - would simply be perpetuated. Obviously preferable would be some immense SDI service through which a scientist is automatically notified of any new report, added to any accessible data base, that matches a stored profile of his interests. He could then use his terminal to access the full text of any item, brought to his attention by the SDI service, that he wishes to pursue further.

The implementation of a global SDI service of this kind is technologically feasible right now, but it raises major questions relating to organization, administration and division of responsibility. How many SDI services should exist in the electronic environment and who should manage and maintain them? It would certainly seem inefficient if each publisher of primary data bases must maintain his own SDI program. Perhaps this function would become a prime responsibility of the present publishers of secondary services. Thus, we might expect to see the emergence of national and international on-line SDI services based upon discipline-oriented and mission-oriented secondary data bases.

The individual user would be billed for the amount of SDI service he receives, the great size of the population served bringing the cost per individual down to a figure that could become rather insignificant. The SDI services used would bring the scientist citations, and perhaps abstracts, of new literature (from all types of sources) matching his interest profile. For each item brought to his attention in this way, the system will be able to provide, on request, an indication of how he can access the full text and how much it will cost to access it. If the scientist chooses to access the complete text of any item, which would be maintained in the files of a primary publisher, he must presumably pay for the privilege of doing so. The paperless communication system is likely to be a much more "pay as you go" one, with an individual paying for just as much as he chooses to use rather than subscribing to conventional journal packages, a large part of the contents of which may not be directly relevant to his interests.

The secondary publisher would presumably continue to be involved in the indexing and abstracting of the primary literature, although most of the abstracts would simply be those provided by authors and primary publishers. All indexing, of course, will be carried out on-line (which implies the need for dual-screen terminals). The "scope" of a secondary data base, however, would no longer be defined in terms of a list of journals (or other sources) covered. Instead, I foresee the need for various levels of SDI within the communication system. The interest profiles (gigantic ones) of the secondary publishers would be matched against updates of primary data bases so that items of potential interest would be disseminated to these secondary services rapidly and automatically. Perhaps science libraries, and other types of information centers, will acquire their document collections in much the same way. The customers of the secondary publishers, and/or of libraries and other information centers, would in turn have their interest profiles matched regularly against the data bases of these institutions. This, of course, is just one possible "model" for a dissemination system of the future. The model may seem a rather radical departure from the ways in which primary publishers, secondary publishers and libraries now operate. But, if we are indeed moving into an electronic age, such radical departures from tradition are almost inevitable.

The individual scientist, then, can have his interest profile matched regularly against one or more SDI services operated by secondary publishers or by some form of information center. These services, to which he or his institution subscribes, will draw his attention continuously to new literature of all types - research reports, journal articles, dissertations, patents, standards, regulations - corresponding to his current professional interests. I use the terms "continuously" deliberately because I view this as an operation in which the scientist can reasonably expect to get a few things each day in his mail, rather than receiving a much larger output at weekly or monthly intervals.

Any item he has no use for he can dispose of immediately simply by depressing an appropriate key. Items that appear to be of some interest can be pursued at once. Alternatively, he may choose to read off the bibliographic data into his own private electronic files for later action. An item viewed in its entirety can also be placed into private files in much the same way that an article may be photocopied and placed in the paper files of an individual. In the electronic world, the machine-readable file of resources replaces the paper file. But in the private electronic file an item can be indexed in any way, and with as many access points, that the user wishes. The paperless personal file will have infinitely greater search capabilities than the paper files it replaces, and it will occupy virtually no space (since, conceptually at least, a report need exist physically in only one file, its "existence" in other files being achieved through the use of pointers to master files of primary text).

So far we have considered only input to an electronic communication system, dissemination of items within this system, and the building of files of these items. The scientist will also need to search for information - both factual data and text describing particular phenomena of interest. At present, the scientist will seek information of this kind through his own personal files or through conversations with colleagues or consultants. Sometimes (but frequently as a last resort) he will visit a library or other formal information center. In the electronic system all of these approaches to information-seeking may be conducted through the same terminal.

The terminal, of course, gives him access to his own information files (and, possibly, the information files maintained by some of his colleagues or by his department). If these files fail him, his terminal will provide an entry point to a vast array of outside sources. Accessible to him on-line will be machine-readable files that are the electronic equivalents of printed handbooks, directories, dictionaries, encyclopedias, almanacs, and other reference tools. He will also have access to on-line indexes to primary text, presumably built and maintained by those same organizations that provide his SDI services. The scientist will be able to use a "widening horizons" approach to his information seeking in this environment, going from personal files to institutional files to national and international resources. And any useful item of data, or piece of text, that he uncovers during his search can, of course, be added rather easily to his personal information files.

But not only files will be accessible through his terminal. Human resources will also be available to him. On-line conversations (in "real time" or somewhat delayed) can be carried out with consultants, professional colleagues, and information specialists located at information centers or information analysis centers (which may, in fact, be 10,000 miles distant). The electronic mailing system can be expected to displace the present mailing system for much, if not all, of professional and business correspondence. In the electronic world the distinction between formal and informal channels of communication is likely to be much less distinct, and attempts to meld the two forms (e.g., the formation of information exchange groups) will become much more practicable, through rapid and efficient communication processes, than they are in the present print on paper environment.

This brings me to the subheading of my paper: "putting it all together". The implementation of a paperless system, having the general characteristics of that outlined here, is technologically feasible now. In my opinion, there is no real question that completely paperless systems will emerge in science. The only real question is "when will it happen?". We can reasonably expect, I feel, that a rather fully developed electronic information system, having most if not all of the features mentioned, will exist by the year 2000, although it could conceivably come a little earlier.

The implementation of the system will involve the coming together, or rather the deliberate "putting together" of a number of separate services, activities and experiments already in existence. Major steps towards a paperless system have been taken in the last fifteen years. The most significant of these developments has been the very rapid growth in the number of machine readable data bases and data banks and the rapidly increasing accessibility of these resources through on-line technology. We can reasonably expect a continued growth in the number of available data bases, with rapid developments occurring in the social sciences and in the humanities as well as in the sciences, and the achievement of even greater levels of accessibility through the full implementation of information networks of the SCANNET and EURONET types. We can also expect to see increasing bodies of primary text becoming available in machine-readable form as more and more publishers convert to computerized operations. The "editorial processing center", as described by Bamford<sup>3</sup> among others, may provide the opportunity for even small publishers to automate

their production processes. At the same time, significant further improvements will undoubtedly occur in computer and communications technologies and these developments will result in greatly reduced costs in the storage, transmission and exploitation of textual material in very large quantities

Computer text editing capabilities were already quite advanced in 1971 when Van Dam and Rice<sup>4</sup> reviewed the state of the art, and many improvements in this technology have occurred since then. In the business world, "word processing" is replacing "typing" and the paperless office (see, for example, Yasaki<sup>5</sup>) is becoming a reality. Computer conferencing, as described by Price<sup>6</sup>, is developing rapidly and some business organizations are already relying on this form of communication to replace the conventional mail service for intra-company correspondence. We are also beginning to see the establishment of a few small, experimental "journals" in electronic form. On-line systems to support the building of personal information files have been available at several universities in the United States for some years. It would not be an exaggeration, then, to say that all of the features of the model I have described could be implemented today if these various technologies and experiments were brought together to form a new science communication system.

I do not wish to give the impression, however, that no problems of implementation exist. In the Helsinki paper I identified various technological, intellectual and social problems of implementation, and suggested that this sequence was one of increasing complexity. It is not my intention to repeat the discussion of these problems here. It is sufficient to say that, while some of these problems may appear "thorny", they are certainly not insoluble.

I feel that I must conclude this paper with an exhortation. The paperless society is rapidly approaching, whether we like it or not. Everyone attending this meeting will be affected by it in one way or another. We must not bury our heads in the sand. We may choose to ignore the electronic world, but this will not make it go away. Now is the time for responsible organizations to study the implications of the rapid technological changes that are occurring for the operations of publishers, primary and secondary, for the operations of libraries and information centers, and for the individual scientist as producer and user of information. If we do not plan now for the years ahead, we may find the transition to be one of disruption and chaos rather than one of ordered evolutionary progress.

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## THE CONFERENCE EVALUATED

Some reflections by

S.C.Schuler

Former Chairman of the Technical Information Panel of AGARD

### BACKGROUND

This TIP Specialist meeting took place on 22-23 June 1977 at the excellent residential Conference Centre at Lysebu, Voksenkollen which is located about eight miles from Oslo city centre. Some sixty delegates attended the two day meeting and sixteen papers were programmed.

The "forward look" theme of the meeting was to "identify the main trends in communications and information technology and assess their impact on the information specialist" and had been suggested by Anton Disch, the Norwegian meeting co-ordinator. The TIP programme committee fully supported this proposal, but extended the scope of the meeting theme to embrace some general papers, outlining national plans for the future of their Scientific and Technical Information activities.

In the final programme, only six papers were specifically devoted to the main trends in technology, five papers covered national policy or international networks, the remaining five papers dealt with important fringe topics.

### MEETING PRESENTATIONS

The meeting was organised into four main sessions and concluded with a general discussion period on the last afternoon. Unfortunately, due to illness, Anton Disch was unable to attend and his opening paper was not presented. The first session was devoted to general scenario papers which reviewed the Norwegian Scientific and Technical Information scene and gave details of important developments with SCANNET and the future links with EURONET.

In his presentation, "The Future of Primary Scientific Publications" Dr. Grunewald advocated the use of microforms for publishing full papers and for each paper entering the microform store, a synopsis of about one page would be made available in a synopsis journal. This synopsis/microform concept has now been launched jointly by the Chemical Societies in France, Germany and U.K. in its new primary publication the "Journal of Chemical Research". The emergence of the synopsis journal was seen by some speakers, during the discussion period, to be the transition stage to the full "electronic journal" described later by Senders and Lancaster.

Realising the importance of innovation for the improvement of scientific communication, the U.S.A. National Science Foundation has sponsored the publication of a guide book of innovative methods and techniques. This guide book has been produced by Capital Systems Group Inc. Mr. Creager in his presentation explained that slightly more than half of the first edition of the guide is devoted to innovations, which could be used to improve conventional publishing. The remainder deals with the creation of by-products, print-on-paper alternatives, non-print-on-paper and mixed media innovations, trends and prospects. The guide consists of short articles which examine the benefits, problems and limitations, applicability and management considerations. The guide uses a loose leaf format and in order to keep the material dynamic, there are opportunities for international organisations and individuals to participate with new items. While the idea of innovation leaflets is not new, NASA Tech briefs and UK Techlinks have been available for some years, these products have not been particularly rich in the Scientific and Technical Information field. The guide book appears to be a most useful and stimulating project. It will be interesting to follow its progress and perhaps, at a later date, Mr. Creager might report on the guide's application record for innovation transfer.

Facsimile communication offers many important advantages in the STI field, but applications to date have been extremely limited, probably due to current costs of equipment and some transmission deficiencies. Dr. R.Barrett gave an excellent review of the techniques involved, including some novel current applications and prospects for the future. It would appear that during the next five to ten years, facsimile will become more competitive with postal services and may well have a very attractive future as an "electronic mail" service. The principal benefits of facsimile transmission for information transfer include, accuracy of copy, speed and low labour requirements.

Mr. W.K.Lowry from Bell Telephones gave a lively and enthusiastic picture of the "Library in the future". He predicted that, with an "enlightened perspective" the next ten years could be the decade when libraries, generally, will

make more progress than they have made in the past hundred years. He made a strong plea for libraries to change their current ways of doing business. They should apply economic principles and measures, including more attention to operating costs, marketing, planning, telecommunications, use of on-line terminals, elimination of cataloguing backlogs through use of co-operative schemes. Low cost terminals in homes and offices will bring quick access to many large information banks. He stressed the need for libraries to employ supporting technical staff, such as programmers and data base managers, so that full exploitation of the new technologies can be made.

In the third session, an excellent forward looking assessment of the U.S.A. Defence Information and Documentation needs was given by Hubert Sauter. This paper was partially based on the work of a contractor hired to study "DIC's position to-day and to identify DDC's requirements, to plan objectives and to recommend improved information products, services and systems for implementation by 1988". Among the most desirable and feasible events predicted to occur in the next ten years or so were:-

- \* Majority of technical information retrieval would be undertaken by dial up communication lines.
- \* Facsimile transmission cost will be competitive with postal services.
- \* Paper will be replaced as a primary numeric storage medium by digital media.
- \* Access to full text data bases will replace abstracting and indexing as searching tools.

Some other NATO National Documentation Centres might profitably undertake forward looking assessments by hiring an independent agency to review their activities and make recommendations for future developments and services.

There can be little doubt that the creation of the NASA-RECON network in the U.S.A. about ten years ago and the subsequent provision of retro searching services by Lockheeds and other contractors has been of inestimable value in making available information retrieval in the U.S.A. The RECON system was subsequently made accessible in some European countries through the European Space Agencies Documentation Services. With the U.S.A. and E.S.A. experience to build on, the E.E.C. countries have organised their own data base sharing network EURONET, now in its implementing phase, with full operation scheduled for the end of 1978. Mr. G.W.A. Davies explained the detailed preparations now underway and the key factors involved, to offer users on-line access to some hundred different data bases using twenty-nine host computers via the network. Perhaps, one of the most significant achievements arising from the Euronet project has been the agreement by the nine PTT administrations of the Community's member states to implement a common technology. This will result in standardisation of computer telecommunications equipment and procedures. Euronet will clearly emerge as a major force on the European scientific and technical information scene and will, no doubt, have a great influence on the services/operations of libraries and information centres within the community.

Speakers from France, Germany and the United Kingdom gave details of their experience with integrated national scientific and technical information programmes. Of particular interest is the French development of an automatic translation system (TITUS) for translating abstracts in French, English, German, Spanish and Arabic languages. These national programmes have high-lighted a variety of information problems — the realisation that information is a product or a commodity and that commercial interests and economic aspects are of vital importance. There is also the question of confliction of interests between the users and the publishers. It was noted that the British Library has recently set up a centre on User studies. They were also supporting an evaluated experiment with a synoptic journal and the possible use of editorial processing centres for small publishers in the U.K.

The paperless communication system or "electronic journal" of the future formed the topic for the last session and presentations were given by Senders and Lancaster. Professor Senders did not provide a written paper and his talk was largely based on an article entitled "The Scientific Journal of the Future" originally published by the American Sociologist 1976 (Vol.11 August pages 160-164). This forecasts the wide scale use of computers for editorial processing and the availability to the user of the complete text of technical papers via his own on-line terminal. In his opinion, the printed form of the journal will disappear during the next two decades and be replaced by electronic storage and retrieval of the alpha-numeric-graphic content of scientific articles and reports. Professor Senders reminded us that most of us spend a considerable amount of time reading, and almost as much time bemoaning the fact that there is so much to read and we cannot possibly read it all. Also, we are often forced to read what we do not want to. One of the great advantages of the electronic journal concept is, it will be possible to identify and locate speedily particular nuggets, which, in the past, have required so much mining.

Professor Lancaster in his talk on "Paperless Communication Systems" emphasized that computers will continue to increase in power and decline in costs, data transmission methods will become more efficient but less costly and new storage devices will make it feasible to hold large volumes of text. These developments together with the emergence of cheaper computer terminals for the user will eventually lead to the substitution of the electronic medium for the print on paper for a wide variety of applications. He also visualised the widespread use of SDI services. Professor Lancaster made a plea for organisations to study now the implications of the rapid technological changes which are occurring, thus ensuring an ordered evolutionary progress.

The general discussion period at the end of the Conference was inevitably dominated by debate on the "paperless communications systems". The general consensus seemed to be that the electronic journal would probably be a reality by 1990. Many spoke in support of the synopsis journal with full text microfiche storage in data banks, which will become increasingly popular in the interim period.

## GENERAL OBSERVATIONS AND RECOMMENDATIONS

The TIP Meeting Announcement indicated that the aim and scope of the Conference was "to identify the main trends in communications and information technology, to assess their impact on the information specialist, also, to consider other developments which might be desirable". This was an ambitious and challenging theme, but in the event, less than half of the papers attempted to cover this in any detail. Some facets, such as the progress towards the establishment of the "electronic journal" were discussed in general terms, but overall, the programme was, perhaps, short of papers giving details of new hardware, and also exploring other long range developments. However, the Conference was extremely successful in bringing together some experts who were well versed in the latest technological developments and trends and in providing a forum for the exchange of ideas.

A forecast was made that the printed journals of scientific literature are likely to become extinct during the next two decades, due to increased costs and depletion of resources. An "electronic alternative" is the complete electronic storage and retrieval of the alpha-numeric and graphic content of scientific articles and reports available to the user via his on-line terminal.

A subsidiary message came through several papers regarding the likely upsurge during the next decade, in the application and use of on-line terminals and computers for information transmission. The use of paper as the main medium for transmitting information will be greatly reduced. Full text held in microfiche data banks will expand and techniques for retrieval and on-line interrogation will become more widespread.

The use of the synopsis journal concept will be more widely adopted for the main professional journals. Full text being available in microfiche format. Facsimile transmission should find increased application in the STI field.

The TIP Programme committee might consider the possibility of holding another conference, say in two years time, on a similar theme. It would be an advantage if the papers contributed were focussed on the application of advanced or evolving technology to the STI transfer processes.

Some possible topics for papers could include:-

- \* Developments of holographic information storage and retrieval systems (Holography techniques can offer packing densities equivalent or greater than eight hundred thousand bits per square centimeter.)
- \* High density computer memories.
- \* Progress with dial up data and information services which can be used by owners of domestic television receivers fitted with a tele text decoder.
- \* Progress with integrated information retrieval systems providing remote access by video signals to a central micro-form library.
- \* Progress reviews on optical character recognition (OCR) and facsimile transmission.

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<p>AGARD Conference Proceedings No. 225 Advisory Group for Aerospace Research and Development, NATO</p> <p>THE IMPACT OF FUTURE DEVELOPMENTS IN COMMUNICATIONS, INFORMATION TECHNOLOGY AND NATIONAL POLICIES ON THE WORK OF THE AEROSPACE INFORMATION SPECIALIST</p> <p>Published September 1977 90 pages</p> <p>The rapid development of new communication techniques, combined with greatly reduced unit costs of communication hardware, has led to easier access to more information for larger segments of the population. In the area of aerospace scientific and technical information, this development should provide greater</p> <p>P.T.O.</p>	<p>AGARD-CP-225</p> <p>Information scientists Information systems Aerospace industry Telecommunication Government policies</p>	<p>AGARD-CP-225</p> <p>Information scientists Information systems Aerospace industry Telecommunication Government policies</p>

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